

TECHNICAL MEMORANDUM NO 4

CHEMICALS OF CONCERN

**HUMAN HEALTH RISK ASSESSMENT
WALNUT CREEK PRIORITY DRAINAGE
OPERABLE UNIT NO 6**

DRAFT FINAL

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

**U S DEPARTMENT OF ENERGY
Rocky Flats
Golden Colorado**

WALNUT CREEK PRIORITY DRAINAGE
OPERABLE UNIT NO 6

**ENVIRONMENTAL RESTORATION PROGRAM DEPARTMENT
August 1994**

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**APPENDIX L
TO
PHASE I RFI/RI WORK PLAN
OPERABLE UNIT 6**

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CHEMICALS OF CONCERN

Approved By

Name

(Date)

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LIST OF ACRONYMS

µg/kg	microgram per kilogram
µg/L	microgram per liter
µg/m ³	microgram per cubic meter
1,1,1-TCA	1,1,1-trichloroethane
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCE	1,2-dichloroethene
Ag	silver
Al	aluminum
Ba	barium
Be	beryllium
BNACLP	Base-Neutral Analysis (for semi-volatiles) - Contract Laboratory Program
BRA	baseline risk assessment
Ca	calcium
CCL4	carbon tetrachloride
Cd	cadmium
CDPHE	Colorado Department of Public Health and Environment
CHCL3	chloroform
Co	cobalt
Cr	chromium
CRDL	contract required detection limit
Cu	copper
DOE	U S Department of Energy
ECAO	Environmental Criteria and Assessment Office (U S EPA)
EPA	U S Environmental Protection Agency
Fe	Iron
GFAA	Graphite Furnace Atomic Absorption
HEAST	Health Effects Assessment Summary Tables
Hg	Mercury
HHRA	human health risk assessment
HRR	Historical Release Report
IDL	instrument detection limit
IHSS	Individual Hazardous Substance Site
IRIS	Integrated Risk Information System
K	potassium
Li	lithium
Mg	magnesium
mg/kg	milligram per kilogram

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mg/kg-day	milligram per kilogram per day
mg/L	milligram per liter
mg/m ³	milligram per cubic meter
Mn	manganese
Na	sodium
Ni	nickel
NNDT	number of non-detects
OU1	Operable Unit 1
OU2	Operable Unit 2
OU6	Operable Unit 6
OU8	Operable Unit 8
PAHs	polycyclic aromatic hydrocarbons
Pb	lead
PCB	polychlorinated biphenyls
PCE	tetrachloroethene
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PCOC	potential chemical of concern
PERC	tetrachloroethene
PESTCLP	Pesticide Analysis - Contract Laboratory Program
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RFEDS	Rocky Flats Environmental Database System
RFETS	Rocky Flats Environmental Technology Site
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RFP	Rocky Flats Plant
Sb	antimony
SF	slope factor
Si	silicon
Sr	strontium
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TCE	trichloroethene
TCL	Target Compound List
TDS	total dissolved solids
TOC	total organic carbon
TSS	total suspended solids
U R	unit risk

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UHSU	Upper Hydrostratigraphic Unit
UTL	upper tolerance limit
V	vanadium
VOACLP	Volatile Organic Analysis- Contract Laboratory Program
VOC	volatile organic compound
WQPL	Water Quality Parameter List
Zn	zinc

EXECUTIVE SUMMARY

This Technical Memorandum No 4, Chemicals of Concern, is part of the Baseline Risk Assessment for the Walnut Creek Priority Drainage, Operable Unit No 6 (OU6), located at the Department of Energy Rocky Flats Environmental Technology Site (formerly Rocky Flats Plant) in Golden, Colorado

The technical memorandum identifies chemicals of concern that will be included in the Human Health Risk Assessment (HHRA) to assess potential health risk from assumed exposure to the chief contaminants detected in soil, groundwater, and other media sampled in OU6. Chemicals of concern are organic chemicals, metals, or radionuclides that exceed background levels, that are not naturally occurring, and that could pose a health threat under the assumed exposure conditions. They are selected from all analytes detected in each medium using risk-based and other screening methods that identify chemicals that would pose the greatest risk and therefore warrant inclusion in the HHRA. Chemicals of concern also provide the focus for transport modeling and remedy selection.

Chemicals of concern were selected for the following media: surface soil, subsurface soil, groundwater, pond sediment, pond surface water, and stream sediment. Chemicals of concern in each media were selected on an OU-wide basis, that is, data collected at Individual Hazardous Substance Sites (IHSSs) were pooled for each medium so that the chief contributors to risk could be identified for the entire OU.

The following steps were used to identify chemicals of concern:

- Metals and radionuclides above background levels were identified as potential chemicals of concern and retained for further evaluation.
- The essential nutrients calcium, iron, potassium, magnesium, and sodium were eliminated from further evaluation.

- Professional judgement, such as geochemical evaluation or statistical analysis, was applied to eliminate some analytes as potential chemicals of concern
- Chemicals above background levels and detected at 5 percent or greater frequency were included in concentration/toxicity screens to identify the chief contributors to potential risk. These were retained as chemicals of concern for the HHRA
- Chemicals detected at less than 5 percent frequency were not included in the selection of OU-wide chemicals of concern but were evaluated in a separate risk-based screen to identify special-case chemicals of concern that warrant separate evaluation in the HHRA

Table ES-1 summarizes the chemicals of concern identified for each medium in OU6

**TABLE ES-1
ROCKY FLATS OU6
SUMMARY OF CHEMICALS OF CONCERN**

Chemical of Concern	Surface Soil	Subsurface Soil	Groundwater	Pond Sediment	Pond Surface Water	Stream Sediment
Aroclor-1254				X		
Benzo(a)anthracene						X
Benzo(a)pyrene		X		X		X
Benzo(b)fluoranthene		X		X		X
Bis(2-ethylhexyl)phthalate				X		
Indeno(1,2,3-cd)pyrene						X
Acetone					X	
Chloroform			X		X	
1,2-Dichloroethene					X	
Methylene chloride		X	X		X	
Tetrachloroethene			X			
Trichloroethene			X		X	
Antimony	X			X		
Barium		X				
Cobalt						X
Silver	X			X		
Strontium						X
Vanadium	X			X		X
Zinc	X			X		X
Nitrate			X			
Americium-241	X	X	X	X		X
Plutonium-239,240	X	X	X	X		X
Uranium-233,234		X				
Uranium-238		X				
Radium-226			X			
Special - Case Chemicals ⁽¹⁾						
Vinyl chloride			X			

⁽¹⁾ Detected at less than 5 percent frequency, but at relatively high concentration

1 0 INTRODUCTION

This Chemicals of Concern Technical Memorandum is presented as part of the Baseline Risk Assessment (BRA) for the Walnut Creek Priority Drainage, Operable Unit 6 (OU6), located at Rocky Flats Environmental Technology Site (RFETS) in Golden, Colorado. The BRA, which consists of the Human Health Risk Assessment (HHRA) and the Environmental Evaluation, will be included in the Phase I RCRA Facility Investigation/Remedial Investigation (RFI/RI) report for OU6. The RFI/RI is being conducted pursuant to the U.S. Department of Energy (DOE) Environmental Restoration Program, a Compliance Agreement among DOE, the U.S. Environmental Protection Agency (EPA), and the Colorado Department of Public Health and Environment (CDPHE), and the Federal Facility Agreement and Consent Order (Interagency Agreement), signed in 1991.

This technical memorandum has been developed to select chemicals of concern to be evaluated in the HHRA. The HHRA will evaluate potential human health risks for on-site and off-site receptors under current land use and potential future land use conditions, assuming no remedial action takes place at OU6. Chemicals of concern are organic chemicals, metals, or radionuclides that exceed background range, that are environmental contaminants, and that could be a significant threat to human health under the exposure conditions evaluated. Chemicals of concern are identified on an OU-wide basis for each medium (e.g., groundwater, soil) through which exposure to contaminants could occur. The identification of chemicals of concern will also help focus the efforts of environmental transport modeling, description of the nature and extent of contamination, and remedy selection.

Chemicals of concern are selected for surface soil, subsurface soil, groundwater, pond surface water, pond sediment, and stream sediment. These media were sampled during the Phase I RFI/RI in accordance with the Phase I RFI/RI Work Plan for Operable Unit 6 (DOE 1992). Chemicals of concern are identified on an OU-wide basis, by pooling sample analytical results from the various sampling locations for each medium. OU6 consists of 19 Individual Hazardous Substance Sites (IHSSs), whose locations are shown in Figure 1-1. The IHSSs

or IHSS groups and the environmental media sampled at each are listed below IHSS groups contain several individual sites, for example, IHSS 142 consists of 10 ponds in the Walnut Creek drainage, numbered 142 1 through 142 9 and 142 12

IHSS or IHSS Group	Name	Surface Soil	Subsurface Soil	Ground- water	Surface Water	Pond Sediment	Stream Sediment
141	Sludge Dispersal Area	X		X			
142	Ponds			X	X	X	
143	Old Outfall	X	X	X			
156	Soil Dump Area	X	X	X			
165	Triangle Area	X	X	X			
166	Trenches A B,C		X	X			
167	Spray Fields	X	X	X			
216	East Spray Field	X	X	X			
--	Streams						X

This technical memorandum is divided into the following sections Section 2 0 describes the general process used to select chemicals of concern Sections 3 0 through 8 0 present decision criteria specific to each medium and identify the chemicals of concern selected for each medium References are listed in Section 9 0

Appendix A, "Background Comparison for Metals and Radionuclides," summarizes the statistical methodology used to compare OU6 data to background data and includes tables showing the results of the statistical tests Statistical tests were used to identify metals and radionuclides whose concentrations exceed background levels and which may be environmental contaminants These metals and radionuclides are retained for further evaluation as potential chemicals of concern

Appendix B, "Risk-Based Evaluation of Infrequently Detected Chemicals," presents the screening of infrequently detected compounds (<5 percent detection frequency) to identify

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those that merit further evaluation as special-case chemicals of concern on the basis of an extremely high concentration in a small area of localized contamination

Appendix C, "Total Suspended and Dissolved Solids in Groundwater," is included to support the discussion of chemicals of concern in Section 5 0

2 0 CHEMICALS OF CONCERN SELECTION PROCESS

2 1 OVERVIEW

The flow chart for selecting chemicals of concern for OU6 is presented in Figure 2-1, Process for Identifying Chemicals of Concern. The process is intended to identify the chief environmental contaminants in each medium that could have adverse impacts on public health. In this way, the risk assessment is focussed on OU6 contaminants that are potentially significant health hazards. Inorganic compounds whose concentrations are within background range or that are essential nutrients or major cations are excluded from the risk assessment. Organic compounds that would contribute insignificantly to overall risk are identified but are not included in the quantitative risk assessment.

Chemicals of concern were selected on an OU-wide basis for each medium. The individual steps shown in Figure 2-1 are listed below and described in the following sections:

- 2 2 Data Evaluation
- 2 3 Background Comparison for Inorganic Compounds
- 2 4 Essential Nutrient/Major Cation and Anion Screen
- 2 5 Frequency of Detection
- 2 6 Concentration/Toxicity Screens
- 2 7 Application of Professional Judgment
- 2 8 Risk-Based Evaluation of Infrequently Detected Compounds and Identification of Special-Case Chemicals of Concern

2 2 DATA EVALUATION

2 2 1 Media-Specific Data Sets

Analytical data from environmental samples collected during the OU6 field sampling program and the site-wide sampling programs were used to characterize contamination in OU6. The

samples were collected from August 1992 through May 1993. Table 2-1 lists the chemical groups and media sampled at each IHSS. Table 2-2 lists the target compounds in each chemical group. Samples were collected from the following media: surface soil, subsurface soil, groundwater, pond sediment, pond surface water, stream sediment, and dry sediment. The number of samples, sampling locations, and other features of the sampling and analytical program are discussed in the Phase I RFI/RI Work Plan for Operable Unit 6 (DOE 1992).

Surface Soil

Surface soil samples were collected using the RFP soil method, a composite method in which the top 2 inches of soil are collected. Samples were collected from the third quarter of 1992 through the first quarter of 1993. The analytical parameters varied among IHSSs as described below.

IHSS 141 (Sludge Dispersal Area) - Forty surface soil samples were collected. Samples were analyzed for pesticides/PCB, metals, nitrate, and radionuclides.

IHSS 156.2 (Soil Dump Area) - Twenty-two surface soil samples were collected. Samples were analyzed for metals, radionuclides, and total organic carbon (TOC).

IHSS 165 (Triangle Area) - Fifteen surface soil samples were collected. Samples were analyzed for metals, radionuclides, and TOC.

IHSSs 167.1 (North Spray Field) - Thirty-two surface soil samples were collected in IHSS 167.1 and 8 in an area near the South Spray Fields. Samples were analyzed for metals, radionuclides, and TOC.

IHSS 216.1 (East Spray Field) - Six surface soil samples were collected. Samples were analyzed for metals, radionuclides, and TOC.

Subsurface Soil

Subsurface soil samples were collected from the fourth quarter of 1992 through the first quarter of 1993. Subsurface soil analytical parameters and depth intervals varied among IHSSs, as described below.

IHSS 156.2 (Soil Dump Area) - Twenty-two soil borings were drilled 3 feet into the undisturbed soil beneath the fill. Samples were taken continuously in these soil borings and composited for each 6-foot interval. Samples were analyzed for volatile organic compounds (VOCs), metals, and radionuclides. The thickness of the fill is approximately 7½ feet across the site.

IHSS 165 (Triangle Area) - Nine soil borings were drilled 3 feet into weathered bedrock. Two monitoring wells, 76192 and 76292, were drilled to depths of 20 and 22½ feet, respectively. Six-foot composite samples were collected from the soil borings prior to the development of monitoring wells. Samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), metals, and radionuclides.

IHSSs 166.1-3 (Trenches A, B, C) - Twenty-six borings were drilled to 5 feet below the bottom of each trench. Eight borings were drilled in Trench A, seven borings in Trench B, six borings in the western part of Trench C, and five borings in the eastern part of Trench C. Samples were analyzed for VOCs, metals, and radionuclides.

IHSSs 167.1 (North Spray Field) - Twenty-three borings were drilled in the North Spray Field. Nine soil borings were also drilled in the South Spray Field area. The soil borings were sampled in 2-foot intervals to a depth of 4 feet. Samples were analyzed for metals, radionuclides, and TOC.

IHSS 216.1 (East Spray Field Area) - Six soil borings were drilled to a depth of 4 feet. The soil borings were sampled in 2-foot intervals. Samples were analyzed for metals, radionuclides, and TOC.

Groundwater

Groundwater samples were collected from onsite monitoring wells on a quarterly basis under a plant-wide groundwater sampling program. The plant-wide monitoring program included two monitoring wells installed during the OU6 Phase I investigation and wells installed during other investigations conducted from 1991 through 1993.

Samples used for evaluation of OU6 groundwater contaminant concentrations were collected from the first quarter of 1991 through the fourth quarter of 1993. The number of groundwater samples collected by analyte group were: 279 samples for VOC analysis (11 analyzed by method 502.2, 22 analyzed by method 524.2, and 246 analyzed by method VOACLPL), 14 samples for SVOC analysis by method BNACLPL, 11 samples for pesticides/PCB analysis by PESTCLPL, 191 filtered samples for metals analysis, 107 unfiltered samples for metals analysis, 172 filtered samples for radionuclide analysis, 138 unfiltered samples for radionuclide analysis, and 279 samples for analysis of water quality parameters (WQPLs).

Stream Sediments

Fifteen sediment samples from the stream channels of the A and B Series Ponds were collected in May 1993 during the OU6 Phase I investigation. Two-foot composite samples were collected using a 2-inch diameter core sampler with a hand driver. The samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, radionuclides, and WQPLs.

Dry Sediments

Eighteen dry sediment samples were collected in the floodplains of the A and B series ponds in February 1993. The samples were collected using the RFP soil sampling method. The samples were analyzed for SVOCs, pesticides/PCBs, metals, radionuclides and WQPLs.

Pond sediments

Pond sediment samples were collected during the fourth quarter of 1992 as part of the site-wide surface water sampling program. Each of the ponds were sampled at five locations. In each pond, one of the samples was collected within 5 feet of the inlet. The second sample was collected from the deepest part of each pond. The other three samples were collected at random locations within each pond. Composite samples were collected from 2-foot intervals. If the sediment depth was greater than 2 feet, an additional sample was collected from 2 to 4 feet. In total, seven samples were collected from the 2 to 4 foot interval.

Fifty-seven pond sediment samples are included in the data set. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, radionuclides, and WQPLs.

Pond Surface Water

Pond surface water samples were collected in the third and fourth quarters of 1992 as part of the site-wide surface water sampling program. Five surface water samples were collected from each of the four A Series Detention Ponds, from each of the five B Series Detention Ponds, and from the Walnut and Indiana Pond. One of the five samples was collected from the deepest part of each pond. A second sample was collected from within 5 feet of the inlet to each pond. The third sample was collected within 5 feet of each spillway. The two remaining samples were collected randomly in each pond. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, filtered metals, unfiltered metals, filtered radionuclides, unfiltered radionuclides and WQPLs.

2 2 2 Data Review and Editing

The OU6 Phase I field program began in August 1992 and was completed in May 1993. A total of 103,000 sample analytical results were reported for OU6. Ninety-two percent of the data (or 95,000 results) has been validated by the validation contractor. The process used to review and edit the OU6 data is described below.

Monthly data deliveries were received from the Rocky Flats Environmental Data System (RFEDS) until January 15, 1994. The data deliveries were segregated by validated and nonvalidated data. After the last delivery, it was determined which data were not received and which were received but not validated. The data identified as being received but not validated were merged with the validated data set.

In total, 95 analytical results were not received. Of these, 31 were from samples cited as having insufficient sample volume (all were for radionuclides). Fifteen were from samples received by the laboratory and not yet analyzed (all of these samples are laboratory replicates for radionuclides). Twenty-three results were missing because samples were lost during shipment to the laboratory. Fifteen of these results were associated with three radionuclide samples. A complete data set for OU6, with the exception of results unreported as of January 15, 1994, is part of the OU6 Draft Phase I RFI/RI Report (DOE 1994a).

Quality control samples, such as equipment rinsates, field and trip blanks, spikes, and surrogates were removed from the data set. The data were then checked for multiple reported results for the same sample. When multiple records were identified, RFEDS personnel were consulted to assist in determining which results to retain in the data set. Field duplicates and the associated real sample were identified and averaged, and the average was used as the result for that sample.

The following laboratory data qualifiers were applied by the analytical laboratory to some of the results

The B-qualifier for a metal result indicates that the reported concentration is greater than the instrument detection limit (IDL) but less than the contract required detection limit (CRDL) for that analyte. These data were used as reported.

The B-qualifier for organics indicates the analyte was found in the method blank and the real sample. These data were used as reported if they were not qualified as non-detect on the basis of laboratory contamination (U-qualified) by the validation contractor.

E-qualified data (exceeded the calibration range) were replaced with the associated D-qualified data (diluted to within calibration range), if the D-qualified record was received. When only the E-qualified result was reported, it was used as reported.

R-qualified (rejected) data were removed from the data set. For OU6, 555 results were rejected (radionuclides comprised 233 of the rejected results). This represents approximately one-half of 1 percent of the data.

Analytical results were J-qualified if the analyte was positively identified below the quantitation limit. The result was considered an estimate because of the uncertainty associated with detected concentration at low levels. Data qualified with a J were used as reported.

A U-qualifier assigned to an analytical result indicates that the analyzed chemical was not detected above the sample quantitation limit. The U-qualifier (applied by the laboratory or by the validation contractor) was the primary mechanism used for evaluating detection frequency for organic and inorganic constituents.

For radionuclides, negative values were used as reported, therefore, there were no non-detect results for radionuclides

2.3 BACKGROUND COMPARISON FOR INORGANIC COMPOUNDS

Analytical results for metals and radionuclides were compared to background levels derived from data for subsurface soils, groundwater, seeps/springs, and stream sediment reported in the Background Geochemical Characterization Report (DOE 1993) and from background surface soil samples collected in the Rock Creek area during the 1991 OU-1 Phase III investigation and the 1993 OU-2 Phase II investigation. Metals and radionuclides whose concentrations did not exceed background levels were eliminated from further consideration as potential chemicals of concern.

Appendix A presents the background comparison methodology in detail and contains summary tables of statistical results for metals and radionuclides in all media. The criteria used to evaluate whether a metal or radionuclide exceeded background levels are summarized here:

- a. Analytical results for metals and radionuclides were compared to the background data using four statistical tests: the Quantile test, Slippage test, Student's t-test, and the Gehan test as described in the letter report of Gilbert (Gilbert 1993). Test conditions and treatment of non-detect values are discussed in Appendix A. The analyte was considered to be above background if it failed any test at the $p \leq 0.05$ level.
- b. $UTL_{99/99}$ comparison. Analytical results for each metal and radionuclide were compared to the 99 percent upper tolerance limit of background data calculated at the 99 percent confidence level ($UTL_{99/99}$). The $UTL_{99/99}$ test is an indicator of possible hot spots (Gilbert 1993), but with large sample sizes of one to two hundred, it is to be expected that one or two data points would exceed the $UTL_{99/99}$ value. Nevertheless, if any result exceeded the $UTL_{99/99}$, the analyte

was identified as a potential chemical of concern, subject to spatial and temporal analysis

2.4 ESSENTIAL NUTRIENT/MAJOR CATION AND ANION SCREEN

Calcium, iron, magnesium, potassium, and sodium were eliminated from further consideration as chemicals of concern because they are essential nutrients, they occur naturally in the environment, and they are toxic only at very high doses. Anions in groundwater other than nitrates were not evaluated.

2.5 FREQUENCY OF DETECTION

All organic compounds and metals above background levels were evaluated for frequency of detection. Compounds that were detected at a frequency of 5 percent or greater were considered potential OU-wide chemicals of concern. These compounds were included in concentration/toxicity screens to identify compounds that could contribute significantly to total risk (see Section 2.6). Compounds detected at less than 5 percent frequency can be eliminated from further consideration because the compound is not characteristic of site contamination and the potential for exposure is low. Nevertheless, maximum concentrations of infrequently detected organic compounds and metals were compared to risk-based concentrations as described in Section 2.8 to identify isolated or highly localized occurrences of high concentrations of chemicals (i.e., hot spots) that could pose a health risk if routine exposure were to occur. These chemicals were retained as special-case chemicals of concern for evaluation in the risk assessment. Since there were no non-detect results for radionuclides (negative values were used as reported), radionuclides were considered to be detected at 100 percent frequency.

2 6 CONCENTRATION/TOXICITY SCREEN

Chemicals of concern in each medium were selected using concentration/toxicity screens for noncarcinogens, carcinogens, and radionuclides. The screens included organic chemicals and inorganics above background levels that were detected at 5 percent frequency or greater. The purpose of applying the screen is to focus the risk assessment on the chief contributors to potential risk. To perform the screen, each chemical in a medium (such as groundwater) is scored according to its maximum detected concentration and toxicity to obtain a risk factor. The risk factor for noncarcinogenic effects is the maximum detected concentration divided by the EPA Reference Dose (RfD) for that chemical. The risk factor for carcinogenic effects (and for radionuclides) is the maximum detected concentration (or activity) multiplied by the EPA cancer slope factor (SF) for that chemical (or radionuclide). The chemical-specific risk factors are summed to calculate total risk factors for the noncarcinogenic, carcinogenic, and radioactive chemicals of potential concern in each medium. The ratio of the risk factor for each chemical to the total risk factor is called a risk index, the risk index approximates the relative risk associated with each chemical in the medium. Separate concentration/toxicity screens were performed for carcinogenic and noncarcinogenic effects of organic compounds and metals and for carcinogenic effects of radionuclides.

Each chemical that comprised 1 percent or more of the total risk factor was considered a chemical of concern for evaluation in the quantitative risk assessment. This approach reduces the number of chemicals to be carried through a risk assessment. However, the approach is conservative (health protective) because it retains some chemicals that contribute as little as 1 percent of the total potential risk in that medium. In most cases, only a few chemicals contribute the majority of potential risk in each medium.

EPA-recommended toxicity factors (RfDs and cancer SFs) were used in the concentration/toxicity screens. When toxicity values were available for both inhalation and oral exposure routes, the more conservative value was used in the screen, unless that route was negligible (these exceptions are noted in the concentration/toxicity values). SFs and RfDs were

determined from IRIS (EPA 1994), HEAST (EPA 1993) and other EPA sources if available. The toxicity factors used in the screens are listed in Tables 2-3 and 2-4.

EPA-established toxicity factors are not available for some of the potential chemicals of concern. Therefore, these analytes cannot be included in the concentration/toxicity screens, in other toxicity-based screens, or in the quantitative risk assessment. OU6 contaminants without toxicity factors were identified for each medium and are listed in each section. The potential impact of these compounds on overall risk will be addressed qualitatively in the human health risk assessment.

2.7 APPLICATION OF PROFESSIONAL JUDGMENT

Professional judgment was used at two points in the process of selecting chemicals of concern for health risk assessment:

1. Exclusion of some potential chemicals of concern based on log-normal $UTL_{99/99}$ comparison. The background $UTL_{99/99}$ presented in the Background Geochemical Characterization Report (DOE 1993) were calculated assuming that the background data were normally distributed. This assumption may not be appropriate for all analytes. Concentrations of some analytes were within background range according to the formal statistical tests, but one or two results exceeded the background $UTL_{99/99}$. This resulted in identifying the analyte as a potential chemical of concern. For some of these analytes, the distribution of the background data were tested. If the better fit was to a log normal distribution, the $UTL_{99/99}$ was recalculated based on log-normal distribution and the site results were compared to the log-normal-based $UTL_{99/99}$. This resulted in removing some analytes as potential chemicals of concern. These are noted in the tables in Appendix A.
2. Spatial/temporal and geochemical evaluation. The spatial and temporal distribution and geochemical characteristics of certain metals and radionuclides

identified as being above background levels were evaluated to support a conclusion as to whether they were likely to be naturally occurring or due to environmental contamination. For example, manganese in groundwater was concluded to be naturally occurring based on spatial, temporal, and geochemical evaluation. This judgment process resulted in removing several metals and radionuclides as potential chemicals of concern in various media. All such professional judgment is described in each section, where relevant.

2.8 RISK-BASED EVALUATION OF INFREQUENTLY DETECTED COMPOUNDS AND IDENTIFICATION OF SPECIAL-CASE CHEMICALS OF CONCERN

Chemicals detected infrequently (in less than 5 percent of all samples in the medium) can usually be eliminated from consideration as chemicals of concern because they are not characteristic of site contamination and the potential for exposure is low. However, these compounds were further screened so as not to neglect an infrequently detected compound that could contribute significantly to risk if routine exposure to a hot spot were to occur. In this analysis, maximum measured concentrations were compared to screening levels equivalent to 1000 times risk-based concentrations (RBCs) (DOE 1994b). This analysis is summarized below and is presented in detail in Appendix B.

For screening purposes, RBCs were defined as chemical concentrations associated with an excess cancer risk of 10^{-6} (1 in 1 million) or a hazard index of one for noncarcinogenic effects, assuming residential exposure to surface soil and groundwater and assuming construction worker exposure to subsurface soil. Any infrequently detected chemical measured at a concentration greater than 1000 times the respective RBC was identified as representing a potentially significant health threat if exposure were to occur and was included in the list of special-case chemicals of concern for evaluation in the risk assessment.

RBCs for chemicals in surface soil were calculated assuming multiple pathway exposure (ingestion and inhalation of particulates). RBCs for chemicals in subsurface soil were

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calculated assuming ingestion of soil and inhalation of particulates and VOCs RBCs for chemicals in groundwater were calculated assuming ingestion of water and inhalation of VOCs The exposure parameters used to calculate RBCs are presented in Appendix B

TABLE 2-2
OU6 PHASE I RFI/RI ANALYTICAL PARAMETERS

TARGET ANALYTE LIST (TAL) - METALS

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Cyanide
Iron, Total, Dissolved
Lead
Magnesium
Manganese, Total Dissolved
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

ADDITIONAL - METALS

Cesium
Lithium
Molybdenum
Silicon
Strontium
Tin

**GRAPHITE FURNACE ATOMIC ABSORPTION
(GFAA) - METALS**

Cadmium
Copper
Iron, Total
Lead
Manganese
Silver
Zinc

TARGET COMPOUND LIST (TCL) - VOCs

Chloromethane
Bromomethane
Vinyl chloride
Chloroethane
Methylene chloride
Acetone
Carbon disulfide
1,1-Dichloroethene
1,1-Dichloroethane
total 1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
2-Butanone
1,1,1-Trichloroethane
Carbon tetrachloride
Vinyl acetate
Bromodichloromethane
1,1,2,2-Tetrachloroethane
1,2-Dichloropropane
cis-1,3-Dichloropropene
Trichloroethene
Dibromochloromethane
1,1,2-Trichloroethane
Benzene
trans-1,3-Dichloropropene
Bromoform
2-Hexanone
4-Methyl-2-pentanone
Tetrachloroethene
Toluene
Chlorobenzene
Ethyl benzene
Styrene
Total xylenes

TCL - SVOCs

Phenol
bis(2-Chloroethyl)ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl alcohol

TABLE 2-2
(continued)

1,2-Dichlorobenzene	Pyrene
2-Methylphenol	Butylbenzylphthalate
bis(2-Chloroisopropyl)ether	3,3'-Dichlorobenzidine
4-Methylphenol	Benzo(a)anthracene
N-Nitroso-di-n-dipropylamine	Chrysene
Hexachloroethane	bis(2-Ethylhexyl)phthalate
Nitrobenzene	Di-n-octylphthalate
Isophorone	Benzo(b)fluoranthene
2-Nitrophenol	Benzo(k)fluoranthene
2,4-Dimethylphenol	Benzo(a)pyrene
Benzoic acid	Indeno(1,2,3-cd)pyrene
bis(2-Chloroethoxy)methane	Dibenz(a,h)anthracene
2,4-Dichlorophenol	Benzo(g,h,i)perylene
1,2,4-Trichlorobenzene	
Naphthalene	TCL - PESTICIDES/PCBs
4-Chloroaniline	alpha-BHC
Hexachlorobutadiene	beta-BHC
4-Chloro-3-methylphenol	delta-BHC
(para-chloro-meta-cresol)	gamma-BHC (Lindane)
2-Methylnaphthalene	Heptachlor
Hexachlorocyclopentadiene	Aldrin
2,4,6-Trichlorophenol	Heptachlor epoxide
2,4,5-Trichlorophenol	Endosulfan I
2-Chloronaphthalene	Dieldrin
2-Nitroaniline	4,4'-DDE
Dimethylphthalate	Endrin
Acenaphthylene	Endosulfan II
2,6-Dinitrotoluene	4,4'-DDD
3-Nitroaniline	Endosulfan sulfate
Acenaphthene	4,4'-DDT
2,4-Dinitrophenol	Methoxychlor
4-Nitrophenol	Endrin ketone
Dibenzofuran	alpha-Chlordane
2,4-Dinitrotoluene	gamma-Chlordane
Diethylphthalate	Toxaphene
4-Chlorophenyl phenyl ether	Aroclor-1016
Fluorene	Aroclor-1221
4-Nitroaniline	Aroclor-1232
4 6-Dinitro-2-methylphenol	Aroclor-1242
N-Nitrosodiphenylamine	Aroclor-1248
4-Bromophenyl phenyl ether	Aroclor-1254
Hexachlorobenzene	Aroclor-1260
Pentachlorophenol	
Phenanthrene	
Anthracene	
Di-n-butylphthalate	
Fluoranthene	

TABLE 2-2
(concluded)

RADIONUCLIDES

Gross Alpha
Gross Beta
Uranium 233+234, 235, and 238
 (each species)
Americium 241
Plutonium 239/240
Tritium
Cesium 137 Total
Strontium 89 + 90 Total

TOTAL ORGANIC CARBON (TOC)
NITRATE/NITRITE AS N

Parameters Exclusively for Groundwater Samples

FIELD PARAMETERS

pH
Specific Conductance
Temperature
Dissolved Oxygen
Barometric Pressure

WATER QUALITY PARAMETER LIST (WQPL)

Chloride
Fluoride
Sulfate
Carbonate
Bicarbonate
Total Dissolved Solids
Total Suspended Solids

ADDITIONAL PARAMETERS FOR IHSS
142 1-9 AND 12 WATER SAMPLES

DOC
Silicon
Alkalinity

TABLE 2-3
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TOXICITY FACTORS FOR
ORGANIC COMPOUNDS AND METALS

Analyte	Slope Factors 1/(mg/kg day)		EPA Cancer Weight of Evidence	Reference Doses mg/kg day	
	Oral	Inhalation		Oral	Inhalation (*)
1,1-Dichloroethane			C	1.0E-01 (2)	1.40E-01
1,1-Dichloroethene	6.0E-01 (1)	1.7E-01 (1)	C	9.0E-03 (1)	
1,2,4-Trichlorobenzene				1.0E-02 (1)	3.00E-03
1,2-Dichloroethane	9.1E-02 (1)	9.1E-02 (1)	B2		
1,2-Dichloroethene				9.0E-03 (2)	
cis-1,2-Dichloroethene				1.0E-02 (2)	
1,4-Dichlorobenzene	2.4E-02 (2)		C		2.30E-01
2-Butanone			D	6.0E-01 (1)	3.00E-01
2-Chlorophenol				5.0E-03 (1)	
4-Methyl-2-pentanone				5.0E-02 (2)	2.30E-02
4-Methylphenol				5.0E-03 (6)	
Acenaphthene				6.0E-02 (1)	
Acetone				1.0E-01 (1)	
Aldrin	1.7E+01 (1)	1.7E+00 (1)	B2	3.0E-05 (1)	
Aluminum				2.9E+00 (6)	
Anthracene				3.0E-01 (1)	
Antimony				4.0E-04 (1)	
Arsenic	1.7E+00 (7)	1.5E+01 (7)	A	3.0E-04 (1)	
Barium				7.0E-02 (1)	1.40E-04
Benzene	2.9E-02 (1)	2.9E-02 (1)	A	-	
Benzo(a)anthracene	7.3E-01 (4)		B2		
Benzo(a)pyrene	7.3E+00 (4)		B2		
Benzo(b)fluoranthene	7.3E-01 (4)		B2		
Benzo(k)fluoranthene	7.3E-02 (4)		B2		
Benzoic acid				4.0E+00 (1)	
Benzyl alcohol				3.0E-01 (2)	
Beryllium	4.3E+00 (1)	8.4E+00 (1)	B2	5.0E-03 (1)	
Bis(2-ethylhexyl)phthalate	1.4E-02 (1)		B2	2.0E-02 (1)	
Butylbenzene (sec-tert)				1.0E-02 (6)	
Butyl benzylphthalate			C	2.0E-01 (1)	
Cadmium (food)		6.3E+00 (1)	B1	1.0E-03 (1)	
Cadmium (water)			B1	5.0E-04 (1)	
Carbon disulfide				1.0E-01 (1)	2.90E-03
Carbon tetrachloride	1.3E-01 (1)	5.2E-02 (1)	B2	7.0E-04 (1)	
Chlorobenzene				2.0E-02 (1)	5.70E-03
Chloroform	6.1E-03 (1)	8.0E-02 (1)	B2	1.0E-02 (1)	
Chromium III				1.0E+00 (1)	
Chrysene	7.3E-02 (4)		B2		
Cobalt				6.0E-02 (6)	
Di-n-butylphthalate			D	1.0E-01 (1)	
Di-n-octylphthalate			D	2.0E-02 (2)	
Dibenzo(a,h)anthracene	7.3E+00 (4)		B2		
Diethyl phthalate				8.0E-01 (1)	
Ethylbenzene			D	1.0E-01 (1)	3.00E-01

TABLE 2-3
(Concluded)

Analyte	Slope Factors		EPA Cancer Weight of Evidence	Reference Doses	
	Oral	Inhalation		Oral	Inhalation (*)
Fluoranthene				4 0E 02 (1)	
Fluorene				4 0E 02 (1)	
gamma BHC				3 0E 04 (1)	
Heptachlor epoxide	9 1E+00 (1)	9 1E+00 (1)	B2	1 3E 05 (1)	
Indeno(1 2 3 cd)pyrene	7 3E 01 (4)		B2		
Lithium				2 0E 02 (6)	
Manganese (food)			D	1 4E 01 (1)	1 40E 05
Manganese (water)			D	5 0E 03 (1)	
Mercury			D	3 0E 04 (2)	9 00E 05
Methylene chloride	7 5E 03 (1)	1 6E 03 (1)	B2	6 0E 02 (1)	9 00E 01
Molybdenum				5 0E 03 (1)	
Naphthalene				4 0E 02 (6)	
Nickel (salts)				2 0E 02 (1)	
Nitrate				1 6E+00 (1)	
Pentachlorophenol	1 2E 01(1)		B2	3 0E 02 (1)	
Phenol			D	6 0E 01 (1)	
Polychlorinated biphenyls	7 7E+00 (1)		B2		
Pyrene			D	3 0E 02 (1)	
Selenium				5 0E 03 (1)	
Silver			D	5 0E 03 (1)	
Strontium				6 0E 01 (1)	
Styrene				2 0E 01 (1)	2 86E 01
Tetrachloroethene	5 2E 02 (5)	2 0E 03 (5)	B2	1 0E 02 (1)	
Thallium (oxide)				7 0E 05 (2)	
Tin				6 0E 01 (2)	
Toluene			D	2 0E 01 (1)	1 10E 01
Trichloroethene	1 1E 02 (5)	6 0E 03 (5)	B2		
Xylenes				2 0E+00 (1)	
Vanadium			-	7 0E 03 (2)	
Zinc			D	3 0E 01 (1)	

Sources

(1) = IRIS

(2) = HEAST 1993 and Supplement (EPA 1993a)

(3) = HEAST 1993 Table 2 (EPA 1993a)

(4) = (EPA 1993b)

(5) = Joan S. Dollard et al. Superfund Health Risk Technical Support Center "Carcinogenicity Characterization of Perchloroethylene (PERC) and Trichloroethylene (TCE) (Luke Air Force Base, Arizona) ECAO

(6) = Provisional values for aluminum, butylbenzene, cobalt, lithium, and naphthalene USEPA ECAO

(7) = Converted from IRIS unit risks Oral proposed UR = 5 00E 05/ug/L Inhalation UR = 4 30E 03/ug/m3

Oral SF = 5 00E 05 x 1000ug/mg x 70kg/2L Inhalation SF = 4 30E 03/ug/m3 x 1000ug/mg x 70kg/20m3

* Calculated from RfC RfD = RfC x 20m3/day/70kg

Group A Human carcinogen (sufficient evidence of carcinogenicity in humans)

Group B Probable human carcinogen

B1 Limited evidence of carcinogenicity in humans

B2 Sufficient evidence of carcinogenicity in animals with inadequate or limited evidence in humans

Group C Possible human carcinogen (limited evidence of carcinogenicity in animals, inadequate or lack of human data)

Group D Not classifiable as a human carcinogen (inadequate or no evidence)

Group E Evidence of noncarcinogen for humans (no evidence of carcinogenicity, inadequate studies)

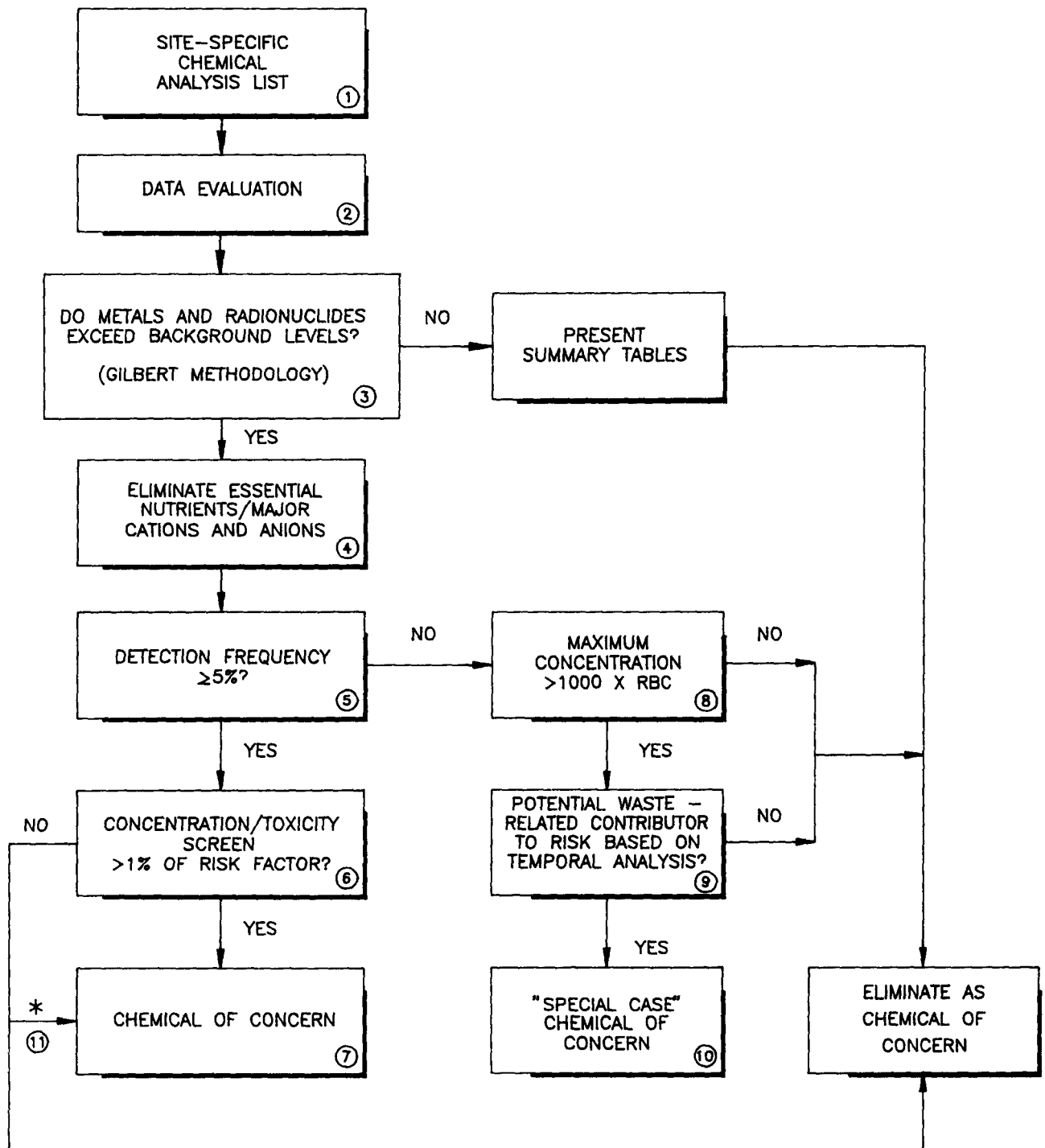
**TABLE 2-4
ROCKY FLATS OU6
SLOPE FACTORS
FOR RADIONUCLIDES**

Analyte	Oral (Risk/pCi)	Inhalation (Risk/pCi)	External (Risk/yr/pCi/g)	EPA Cancer Weight of Evidence
Americium-241	2 4E-10	3 2E-08	4 9E-09	A
Cesium-137 +D	2 8E-11	1 9E-11	2 0E-06	A
Plutonium-239	2 3E-10	3 8E-08	1 7E-11	A
Plutonium-240	2 3E-10	3 8E-08	2 7E-11	A
Radium-226 +D	1 2E-10	3 0E-09	6 0E-06	A
Radium-228 +D	1 0E-10	6 9E-10	2 9E-06	A
Strontium-89	3 0E-12	2 9E-12	4 7E-10	A
Strontium-90 +D	3 6E-11	6 2E-11	0 0E+00	A
Tritium	5 4E-14	7 8E-14	0 0E+00	A
Uranium-233 234 *	1 6E-11	2 6E-08	3 0E-11	A
Uranium-235 +D	1 6E-11	2 5E-08	2 4E-07	A
Uranium-238 +D	2 8E-11	5 2E-08	3 6E-08	A

Source HEAST 1993 (EPA 1993a)

* = Slope factors shown are for U-234

+D = Risks from radioactive decay products included



* PROFESSIONAL JUDGEMENT
RBC RISK-BASED CONCENTRATION (USD OE 1994)

U S DEPARTMENT OF ENERGY Rocky Flats, Golden, Colorado
OPERABLE UNIT NO 6 TECHNICAL MEMORANDUM NO 4
PROCESS FOR IDENTIFYING CHEMICALS OF CONCERN - OUG HUMAN HEALTH RISK ASSESSMENT

FIGURE 2-1 AUGUST 1994

3 0 SURFACE SOIL CHEMICALS OF CONCERN

3 1 SURFACE SOIL DATA SET

Chemicals of concern in surface soil were selected using data collected at all OU6 IHSSs at which surface soil samples were collected, with the exception of samples collected at the Old Outfall (IHSS 143). The Outfall data are omitted from this OU-wide chemicals of concern determination because special physical features of the Old Outfall and its location within the industrialized portion of RFETS indicate that a separate evaluation of this IHSS is warranted. The Old Outfall is a small site located approximately 10 feet below ground surface within the industrialized portion of the plant, surface and near-surface soils at this site are fill brought in for grading. As is being done for all OU6 IHSSs, the nature and extent of contamination detected in soil and groundwater samples collected at IHSS 143 will be evaluated in the OU6 RI/RFI report, and, as is being done for all OU6 contaminant source areas, maximum contaminant concentrations detected at the Old Outfall will be compared to risk-based screening concentrations to estimate potential health risk. (The risk-based screen for OU6 source areas is contained in a separate letter report [DOE 1994c]). However, if further evaluation of potential health risk at the Old Outfall is warranted based on results of the risk-based screen, the evaluation will be conducted separately from the BRA for OU6, and remediation of the Old Outfall, if warranted, will occur under OU8, which includes portions of the industrialized area. Therefore, surface and subsurface soil sample results from IHSS 143 were not included in the selection of OU-wide chemicals of concern in soil. Maximum contaminant concentrations detected in surface and subsurface soil at IHSS 143 are shown for information purposes in Table 3-1.

The data set for selecting OU-wide chemicals of concern in surface soil includes samples collected at IHSSs 141 (Sludge Dispersal Area), 156 2 (Soil Dump Area), 165 (Triangle Area), 167 1 (North Spray Field), and 216 1 (East Spray Field). The data set includes 119 surface soil samples that were analyzed for metals and anywhere from 18 to 125 samples analyzed for various radionuclides. In addition, 55 surface soil samples at the Sludge Dispersal Area (IHSS 141) and the Triangle Area (IHSS 165) were analyzed for

pesticides/PCBs The sampling and analytical program is summarized in Tables 2-1 and 2-2. The number of samples for each inorganic analyte are listed in the Background Comparison Summary Tables in Appendix A.

3.2 BACKGROUND COMPARISON AND FREQUENCY OF DETECTION

Tables 3-2 and 3-3 summarize the maximum detected concentrations and detection frequencies for organic compounds and metals, and the results of the background comparison for metals in OU6 surface soil samples. The statistical comparisons to background data are presented in detail in Appendix A. Only molybdenum and Aroclor-1254 were detected at less than 5 percent frequency (i.e., both negative and positive results are retained in the data set). Radionuclides are assumed to be detected at 100 percent frequency (i.e., both negative and positive results are retained in the data set). Radionuclides identified as potential chemicals of concern based on the background comparison are listed in the concentration/toxicity screen in Table 3-5.

Background surface soil data consist of analytical results from samples collected at 18 locations in the Rock Creek area. Nine of the sites were sampled in February 1992 and the remaining nine sites were sampled in March 1993. All background and OU6 surface soil samples were collected using the RFP method, a composite method in which the top 2 inches of soil are collected.

Metals and radionuclides that were detected at 5 percent or greater detection frequency and that were identified as potential chemicals of concern on the basis of the statistical background comparison or exceedances of the background $UTL_{99/99}$ were included in concentration/toxicity screens to select OU-wide chemicals of concern.

Copper and lead were detected above background levels in surface soils but do not have EPA toxicity factors and, therefore, cannot be evaluated in a toxicity- or risk-based screen. The potential contribution of these metals to overall risk will be evaluated qualitatively in the risk assessment. Maximum concentrations of these metals were relatively low (copper = 62

mg/kg, lead = 69 mg/kg) and are not expected to have adverse health effects. If the detected lead levels in soil were at a level of concern, the potential for adverse effects in children will be estimated using EPA's Integrated Exposure Uptake Biokinetic Model for Lead (EPA 1994b). However, lead levels in surface soil do not appear to warrant quantification of adverse effects, since the maximum concentration of 69 mg/kg is well below the residential screening level of 400 mg/kg (EPA 1994c).

3.3 CONCENTRATION/TOXICITY SCREENS

Concentration/toxicity screens for surface soils are presented in Table 3-4 (noncarcinogens) and Table 3-5 (radionuclides). No carcinogenic metals were among the potential chemicals of concern based on background comparison; therefore, there is no concentration/toxicity screen for carcinogens. (An inhalation cancer slope factor specific to nickel subsulfide, which occurs in nickel refinery dust, is available. However, it is considered inappropriate to apply the inhalation cancer slope factor for nickel subsulfide to nickel detected in soil at Rocky Flats because no nickel refining occurred at Rocky Flats, and nickel in soils at Rocky Flats most likely occurs in native minerals or salts or in anthropogenic salts related to industrial processes other than refining. Therefore, nickel is not evaluated as a carcinogen.) All analytes that contribute at least 1 percent of the total risk factor are retained as OU-wide chemicals of concern. OU-wide chemicals of concern for surface soil are listed below and in Table 3-6.

OU-Wide Chemicals of Concern Surface Soil

Antimony
Silver
Vanadium
Zinc
Plutonium-239/240
Americium-241

The distribution of these chemicals of concern in surface soil is shown in Figures 3-1 through 3-6 (results above background mean plus two standard deviations are shown) Antimony and zinc exceeded background levels according to one or more of the four formal statistical tests (quantile, slippage, t-test, or Gehan tests) described in Appendix A Silver and vanadium did not exceed background levels according to the formal statistical tests, but silver had one result above the background UTL_{99/99} (in IHSS 141, Sludge Dispersal Area) and vanadium had four results above the UTL (in IHSS 141, Sludge Dispersal Area, and IHSS 156 2, Soil Dump Area)

Plutonium and americium results exceeded background levels according to the formal statistical tests, and maximum concentrations at each IHSS exceeded the background UTL_{99/99}

Summary data for chemicals of concern in surface soil at each IHSS are listed below

Concentration Ranges of Chemicals of Concern in Surface Soil, mg/kg or pCi/g

IHSS		Antimony	Silver	Vanadium	Zinc	Pu	Am
	Bknd UTL	50	10	55.6	86.6	0.133	0.060
	Bknd Mean+2SD	35	7.1	43.7	71	0.094	0.039
141	Sludge Dispersal	-	8-53	67-76	73-650	0.14-10	0.25-1.8
156 2	Soil Dump	39-44	-	44-65	72	0.10-1.8	0.042-0.301
165	Triangle	-	-	-	75-117	0.09-15	0.061-3.24
167 1	North Spray Field	-	-	-	-	0.10-1.85	0.039-1.15
216 1	East Spray Field	-	-	-	-	0.38-0.76	0.058-0.192

- No results above background mean + 2 standard deviations (SD)

3.4 RISK-BASED EVALUATION OF INFREQUENTLY DETECTED COMPOUNDS

Maximum concentrations of Aroclor-1254 and molybdenum (each detected at 1 percent frequency) were compared to values equivalent to 1000 times chemical-specific RBCs. The RBCs were calculated assuming residential exposure to surface soil and are used to identify special-case chemicals of concern that could pose a health risk if long-term exposure were to occur to maximum concentrations present in a highly localized area. The screen is discussed in Appendix B and the results for surface soil are presented in Table B-1.

None of the maximum concentrations of chemicals detected at low frequency in surface soil exceeded the 1000 times RBC value. Therefore, there are no special-case chemicals of concern in surface soils for OU6.

TABLE 3-1
ROCKY FLATS OU6
MAXIMUM CONCENTRATIONS OF DETECTED ANALYTES
IHSS 143 (OLD OUTFALL)
SURFACE AND SUBSURFACE SOIL

<u>Surface Soil</u>		<u>Subsurface Soil</u>	
Organics and Metals (mg/kg)		Organics and Metals (mg/kg)	
Acenaphthene	0 51	2-Butanone	0 018
Aluminum	16900	Acetone	0 17
Anthracene	0 66	Aluminum	14400
Arsenic	6 6	Arsenic	7 8
Barium	170	Barium	1150
Benzo(a)anthracene	1 8	Benzo(a)anthracene	0 2
Benzo(a)pyrene	2 3	Benzo(a)pyrene	0 17
Benzo(b)fluoranthene	3 2	Benzo(b)fluoranthene	0 21
Benzo(ghi)perylene	0 89	Benzo(k)fluoranthene	0 095
Benzo(k)fluoranthene	1 2	Benzoic acid	1 065
Benzoic acid	0 45	Beryllium	1 4
Beryllium	1 3	Bis(2-ethylhexyl)phthalate	0 41
Bis(2-ethylhexyl)phthalat	0 22	Cadmium	0 75
Cadmium	0 75	Cesium	13 6
Cesium	33 4	Chromium	13 9
Chromium	17 7	Chrysene	0 2
Chrysene	1 6	Cobalt	16 9
Cobalt	12 9	Copper	23 6
Copper	17 8	Di-n-octylphthalate	0 068
Dibenzo(a,h)anthracene	0 2	Fluoranthene	0 45
Dibenzofuran	0 085	Indeno(1,2,3-cd)pyrene	0 088
Fluoranthene	2 7	Lead	23 1
Fluorene	0 24	Lithium	16
Indeno(1,2,3-cd)pyrene	0 89	Manganese	343 5
Lead	31	Mercury	0 93
Lithium	10 8	Methylene chloride	0 013
Manganese	374	Nickel	26 1
Mercury	0 07	Phenanthrene	0 23
Naphthalene	0 12	Pyrene	0 46
Nickel	20 3	Selenium	0 61
Phenanthrene	1 8	Strontium	279
Pyrene	2 8	Thallium	0 51
Selenium	0 4	Toluene	1 055
Strontium	53 8	Vanadium	43 1
Thallium	0 28	Zinc	100 85
Vanadium	45 5		
Zinc	85 4		
Radionuclides (pCi/g)		Radionuclides (pCi/g)	
Plutonium-239/240	0 52	Americium-241	0 0361
Uranium-233/234	1 25	Plutonium-239/240	0 2612
Uranium-235	0 05	Uranium-233,-234	1 843
Uranium-238	1 16	Uranium-235	0 0778
		Uranium-238	1 518

TABLE 3-2
ROCKY FLATS OU6
METALS DETECTED AT 5% OR GREATER FREQUENCY
SURFACE SOIL ⁽¹⁾

Chemical	Maximum Detected Concentration (mg/kg)	Detection Frequency %	Inorganic POC ? ⁽²⁾
Aluminum	24100	100	No
Antimony	43 6	47	Yes
Arsenic	11	100	No
Barium	272	100	No
Beryllium	1 5	90	No
Cadmium	6 4	41	No
Cesium	35 4	86	No
Chromium	35 1	99	Yes
Cobalt	20 3	100	Yes
Copper	61 6	100	Yes
Lead	68 7	100	Yes
Lithium	18 1	95	No
Manganese	823	100	No
Mercury	0 34	41	Yes
Nickel	22 5	95	Yes
Selenium	1 3	35	No
Silver	52 7	8	Yes
Strontium	255	100	Yes
Thallium	0 55	44	No
Tin	38 7	5	No
Vanadium	75 9	100	Yes
Zinc	650	100	Yes

⁽¹⁾ Excluding Old Outfall (IHSS 143)

⁽²⁾ Based on background comparison (Appendix A)

TABLE 3-3
ROCKY FLATS OU6
METALS AND PESTICIDES/PCBs DETECTED AT
LESS THAN 5% FREQUENCY
SURFACE SOIL ⁽¹⁾

Chemical	Maximum Detected Concentration (mg/kg)	Detection Frequency %	Inorganic POC ? ⁽²⁾
Aroclor-1254	0.425	1	
Molybdenum	9.9	1	Yes

⁽¹⁾ Excluding Old Outfall (IHSS 143)

⁽²⁾ Based on background comparison (Appendix A)

TABLE 3-4
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
SURFACE SOIL⁽¹⁾
NONCARCINOGENS

Chemical	Maximum Detected Conc (mg/kg)	Inhalation RfD	Oral RfD	Risk Factor	Risk Index	% of Total Risk Factor
Antimony	43.6	n/a	4.0E-04	1.1E+05	8.0E-01	80.4
Vanadium	75.9	n/a	7.0E-03	1.1E+04	8.0E-02	8.0
Silver	52.7	n/a	5.0E-03	1.1E+04	7.8E-02	7.8
Zinc	650	n/a	3.0E-01	2.2E+03	1.6E-02	1.6
Mercury	0.34	n/a	3.0E-04	1.1E+03	8.4E-03	0.8
Nickel	22.5	n/a	2.0E-02	1.1E+03	8.3E-03	0.8
Strontium	255	n/a	6.0E-01	4.3E+02	3.1E-03	0.3
Cobalt	20.3	n/a	6.1E-02	3.3E+02	2.5E-03	0.2
Chromium III	35.1	n/a	1.0E+00	3.5E+01	2.6E-04	0.0
Total Risk Factor				1.4E+05		

RfDs are in units of mg/kg-day

n/a = not available

⁽¹⁾ Excluding Old Outfall (IHSS 143)

TABLE 3-5
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
SURFACE SOIL ⁽¹⁾
RADIONUCLIDES

Chemical	Maximum Detected Conc (pCi/g)	Inhalation Slope Factor	Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
Plutonium-239 240	15 22	3 8E-08	2 3E-10	4 0E+08	8 0E-01	79 8
Americium-241	3 243	3 2E-08	2 4E-10	1 0E+08	2 0E-01	20 2
Total Risk Factor				5 0E+08		

Slope factors are in units of 1/pCi

⁽¹⁾ Excluding Old Outfall (IHSS 143)

TABLE 3-6
ROCKY FLATS OU6
CHEMICALS OF CONCERN
SURFACE SOIL ⁽¹⁾

OU-Wide	
	Antimony
	Silver
	Vanadium
	Zinc
	Americium-241
	Plutonium-239/240

¹ Excluding Old Outfall (IHSS 143)

4 0 SUBSURFACE SOIL CHEMICALS OF CONCERN

4 1 SUBSURFACE SOIL DATA SET

Chemicals of concern in subsurface soil were selected using data collected at all OU6 IHSSs where subsurface soil samples were collected except the Old Outfall (IHSS 143) because, as explained in Section 3 1, it is proposed to evaluate this IHSS separately from the baseline risk assessment for OU6. Subsurface soil samples from the Old Outfall were therefore excluded from the data set for selecting OU-wide chemicals of concern. IHSSs included in the subsurface soil data set are IHSS 166 (Trenches A, B, and C), 156 2 (Soil Sump Area), 165 (Triangle Area), 167 1 (North Spray Field), and 216 1 (East Spray Field). All samples used for selection of chemicals of concern and in the background comparison were collected above the water table. Samples collected below the water table were not included in the data set to avoid including constituents transported by groundwater.

Over 200 subsurface soil samples were analyzed for metals and radionuclides. Approximately 380 samples were analyzed for volatile organic compounds. Semivolatile organic compounds were also analyzed for in 34 samples collected at the Triangle Area (IHSS 165). The sampling and analytical program at each IHSS is summarized in Tables 2-1 and 2-2.

4 2 BACKGROUND COMPARISON AND FREQUENCY OF DETECTION

Tables 4-1 and 4-2 summarize the maximum detected concentrations and detection frequencies for organic compounds and metals and the results of the background comparison for metals in OU6 subsurface soil samples. Background data for subsurface soils were taken from the Background Geochemical Characterization Report (DOE 1993). The statistical comparisons of inorganic results to background data are presented in detail in Appendix A.

Radionuclides were assumed to be detected at 100 percent frequency (both negative and positive results are included in the data set). Radionuclides above background levels are listed in the concentration/toxicity screen in Table 4-5.

Analytes that were detected at 5 percent or greater detection frequency and that were identified as potential chemicals of concern on the basis of the statistical background comparison or exceedances of the background $UTL_{99/99}$ were included in concentration/toxicity screens to select OU-wide chemicals of concern in subsurface soil

4.3 CONCENTRATION/TOXICITY SCREENS

Concentration/toxicity screens for chemicals in subsurface soils are presented in Tables 4-3 through 4-5. All analytes that contribute at least 1 percent of the total risk factor are retained as OU-wide chemicals of concern for quantitative risk assessment.

Plutonium-239,240 and americium-241 were retained as chemicals of concern in subsurface soil, even though they represented less than 1 percent of the total risk factor. They were retained because

- Plutonium and americium are associated with waste releases at Rocky Flats, whereas other radionuclides may be naturally occurring.
- Plutonium and americium were detected in numerous samples at levels well above background at three IHSSs: 156.2 (Soil Dump Area), 165 (Triangle Area), and 216.1 (East Spray Field).
- The small fraction of the total risk factor represented by plutonium and americium is determined by the maximum activity of uranium-238 (141 pCi/g) used in the concentration/toxicity screen for radionuclides (Table 4-5). Uranium-238 activities above the background $UTL_{99/99}$ of 1.8 pCi/g were detected in only two samples (2.8 and 141 pCi/g, both at IHSS 167.1, North Spray Field). The maximum activity is actually an extreme value that may result in an overestimate of the relative contribution of uranium-238 to overall risk and an underestimate of the relative contribution of plutonium and americium using reasonable maximum exposure concentrations.

Therefore, it is considered reasonable to retain plutonium and americium as chemicals of concern in subsurface soil for evaluation in the quantitative risk assessment

Chemicals of concern are listed below and in Table 4-6

OU-Wide Chemicals of Concern
Subsurface Soil

Methylene chloride
Benzo(a)pyrene
Benzo(b)fluoranthene
Barium
Plutonium-239,240
Americium-241
Uranium-233,234
Uranium-238

The occurrence of methylene chloride in subsurface soil is shown in Figures 4-1 through 4-6. The maximum concentration of 3.75 mg/kg was detected at IHSS 216.1, East Spray Field (Figure 4-5).

The two PAH chemicals of concern, benzo(a)pyrene and benzo(b)fluoranthene, were detected in subsurface soils at IHSS 165 (Triangle Area) (Figure 4-7). The Triangle Area is the only IHSS at which subsurface soil samples were analyzed for SVOCs (excepting IHSS 143, Old Outfall, which was excluded from the determination of OU-wide chemicals of concern).

The occurrence of elevated levels of barium in subsurface soil is shown in Figures 4-8 through 4-11 (concentrations above background mean plus two standard deviations are shown). Barium was detected above background levels in subsurface soil at all IHSSs.

The occurrence of uranium isotopes, plutonium, and americium above background levels is shown in Figures 4-12 through 4-15 (activities above background mean plus two standard deviations are shown).

Chemicals of potential concern in subsurface soil that do not have EPA-established toxicity factors are lead and phenanthrene. These compounds cannot be evaluated in a toxicity- or risk-based screen to select chemicals of concern. However, their potential contribution to overall risk will be evaluated qualitatively in the risk assessment for OU6. Data are inadequate to assess toxicity of phenanthrene, and at the maximum detected concentration (0.17 mg/kg) the potential for adverse effects is likely to be negligible. The maximum lead concentration of 85 mg/kg is well below EPA's screening level of 400 mg/kg for residential soil (EPA 1994c).

4.4 RISK-BASED EVALUATION OF INFREQUENTLY DETECTED COMPOUNDS

Maximum concentrations of 17 VOCs and SVOCs (detected at < 5 percent frequency) were compared to values equivalent to 1000 times chemical-specific RBCs for construction worker exposure to subsurface soil (DOE 1994b). The comparison to RBCs is used to identify special-case chemicals of concern, i.e., infrequently detected compounds that could pose a health risk if long-term exposure were to occur to the maximum detected concentration. The screen is discussed in Appendix B and the results for subsurface soil are presented in Table B-2.

None of the maximum concentrations of chemicals detected at low frequency in subsurface soil exceeded 1000 times the RBC. Therefore, no special-case chemicals of concern were identified for subsurface soils.

TABLE 4-1
ROCKY FLATS OU6
ORGANIC COMPOUNDS AND METALS DETECTED AT
5% OR GREATER FREQUENCY
SUBSURFACE SOIL ⁽¹⁾

Chemical	Maximum Detected Concentration (mg/kg)	Detection Frequency %	Inorganic PCOC ? ⁽²⁾
Organic Compounds			
2 But none	3 7	22	
2-Chlorophenol	0 055	8	
Acetone	5 1	88	
Benzo(a)pyrene	0 13	8	
Benzo(b)fluoranthene	0 17	12	
Benzoic acid	0 26	19	
Bis(2-ethylhexyl)phthalate	0 39	34	
Fluoranthene	0 45	27	
Methylene chloride	3 75	86	
Phenanthrene	0 17	12	
Pyrene	0 19	23	
Toluene	1 1	90	
Metals			
Aluminum	24100	100	No
Antimony	21 65	7	No
Arsenic	10 9	99	No
Barium	2970	100	Yes
Beryllium	2 1	86	No
Cadmium	1 8	7	No
Cesium	33 7	71	No
Chromium	217	98	Yes
Cobalt	21 4	95	No
Copper	52 1	100	No
Lead	84 9	100	Yes
Lithium	29 8	89	No
Manganese	907	100	No
Mercury	0 93	28	No
Nickel	41 5	64	No
Selenium	1 3	8	No
Strontium	506	100	Yes
Thallium	0 69	34	No
Vanadium	118	100	Yes
Zinc	706	100	Yes

⁽¹⁾ Excluding Old Outfall (IHSS 143)

⁽²⁾ Based on background comparison (Appendix A)

TABLE 4-2
ROCKY FLATS OU6
ORGANIC COMPOUNDS AND METALS DETECTED AT
LESS THAN 5% FREQUENCY
SUBSURFACE SOIL ⁽¹⁾

Chemical	Maximum Detected Concentration (mg/kg)	Detection Frequency %	Inorganic PCOC ⁽²⁾
Organic Compounds			
1,4-Dichlorobenzene	0.064	4	
4-Methyl-2-pentanol	0.004	1	
Acenaphthene	0.056	4	
Benzene	0.006	1	
Benzo(a)anthracene	0.099	4	
Benzo(k)fluoranthene	0.06	4	
Chlorobenzene	0.074	0.3	
Chloroform	0.002	0.3	
Chrysene	0.12	4	
Diethyl phthalate	0.3	4	
Di-n-octyl phthalate	0.072	4	
Indeno(1,2,3-cd)pyrene	0.099	4	
Pentachlorophenol	0.66	4	
Phenol	0.055	4	
Styrene	0.001	0.3	
Xylenes, total	0.002	0.3	
Trichloroethene	0.021	2	
Metals			
Molybdenum	27.9	2	No
Silver	2.7	0.4	No
Tin	57.8	3	No

⁽¹⁾ Excluding Old Outfall (IHSS 143)

⁽²⁾ Based on background comparison (Appendix A)

TABLE 4-3
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
SUBSURFACE SOIL⁽¹⁾
NONCARCINOGENS

Chemical	Maximum Detected Conc (mg/kg)	Inhalation RfD	Oral RfD	Risk Factor	Risk Index	% of Total Risk Factor
Barium	2970	1 4E-04	7 0E-02	2 1E+07	1 0E+00	99 9
Vanadium	118	n/a	7 0E-03	1 7E+04	7 9E-04	0 1
Zinc	706	n/a	3 0E-01	2 4E+03	1 1E-04	0 0
Strontium	506	n/a	6 0E-01	8 4E+02	4 0E-05	0 0
Chromium	217	n/a	1 0E+00	2 2E+02	1 0E-05	0 0
Acetone	5 1	n/a	1 0E-01	5 1E+01	2 4E-06	0 0
Methylene chloride	3 75	9 0E-01	6 0E-02	6 3E+01	2 9E-06	0 0
Bis(2-ethylhexyl)phthalate	0 39	n/a	2 0E-02	2 0E+01	9 2E-07	0 0
2-Butanone	3 7	3 0E-01	6 0E-01	1 2E+01	5 8E-07	0 0
Fluoranthene	0 45	n/a	4 0E-02	1 1E+01	5 3E-07	0 0
2 Chlorophenol	0 055	n/a	5 0E-03	1 1E+01	5 2E-07	0 0
Toluene	1 1	1 1E-01	2 0E-01	1 0E+01	4 7E-07	0 0
Pyrene	0 19	n/a	3 0E-02	6 3E+00	3 0E-07	0 0
Benzoic acid	0 26	n/a	4 0E+00	6 5E-02	3 1E-09	0 0
Total Risk Factor				2 1E+07		

RfDs are in units of mg/kg-day

n/a = not available

⁽¹⁾ Excluding Old Outfall (IHSS 143)

TABLE 4-4
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
SUBSURFACE SOIL⁽¹⁾
CARCINOGENS

Chemical	Maximum Detected Conc (mg/kg)	Inhalation Slope Factor	Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
Benzo(a)pyrene	0.13	n/a	7.3E+00	9.5E-01	8.6E-01	85.8
Benzo(b)fluoranthene	0.17	n/a	7.3E-01	1.2E-01	1.1E-01	11.2
Methylene chloride	3.75	1.6E-03	7.5E-03	2.8E-02	2.5E-02	2.5
Bis(2-ethylhexyl)phthalate	0.39	n/a	1.4E-02	5.5E-03	4.9E-03	0.5
Total Risk Factor				1.1E+00		

Slope factors are in units of 1/(mg/kg-day)

n/a = not available

⁽¹⁾ Excluding Old Outfall (IHSS 143)

TABLE 4-5
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
SUBSURFACE SOIL
RADIONUCLIDES

Chemical	Maximum Activity (pCi/g)	Inhalation Slope Factor	Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
Uranium-238	141	5.2E-08	2.8E-11	7.3E-06	9.8E-01	98.2
Uranium-233/234	3.05	2.6E-08	1.6E-11	7.9E-08	1.1E-02	1.1
Plutonium-239/240	0.88	3.8E-08	2.3E-10	3.3E-08	4.5E-03	0.4
Americium-241	0.44	3.2E-08	2.4E-10	1.4E-08	1.9E-03	0.2
Uranium-235	0.16	2.5E-08	1.6E-11	4.0E-09	5.4E-04	0.1
Total Risk Factor				7.5E-06		

Slope factors are in units of 1/pCi

TABLE 4-6
ROCKY FLATS OU6
CHEMICALS OF CONCERN
SUBSURFACE SOIL⁽¹⁾

OU-Wide	
	Benzo(a)pyrene
	Benzo(b)fluoranthene
	Methylene chloride
	Barium
	Americium-241
	Plutonium-239,240
	Uranium-233, 234
	Uranium 238

¹ Excluding Old Outfall (IHSS 143)

5 0 GROUNDWATER CHEMICALS OF CONCERN

5 1 GROUNDWATER DATA SET

Monitoring wells in OU6 were installed in the Upper Hydrostratigraphic Unit (UHSU). Chemicals of concern in groundwater were selected using data collected from first quarter 1991 through fourth quarter 1993. Groundwater samples were analyzed for metals, radionuclides, volatile organic compounds, semivolatile organic compounds, and pesticides/PCBs. The sampling and analytical programs for wells at each IHSS are summarized in Tables 2-1 and 2-2.

5 2 BACKGROUND COMPARISON AND FREQUENCY OF DETECTION

Tables 5-1 and 5-2 summarize the maximum detected concentrations, detection frequencies, and results of background comparison for analytes detected in groundwater. The background comparison and maximum concentrations shown for metals and radionuclides are based on unfiltered sample results. Background data for UHSU groundwater were taken from the Background Geochemical Characterization Report (DOE 1993).

The statistical background comparisons for inorganics are presented in detail in Appendix A. Inspection of Table 5-1 and the Appendix A tables for unfiltered and filtered metals in groundwater reveal that nearly all metals, including typical rock-forming elements such as aluminum, calcium, iron, and sodium, were identified as being above background levels. Metals as potential chemicals of concern are discussed further in Section 5.3.

Radionuclides are assumed to be detected at 100 percent frequency (that is, both negative and positive results are used in the data set). Radionuclides above background levels are listed in the concentration/toxicity screen in Table 5-5.

Several organic contaminants were detected at low concentrations in some groundwater samples. Maximum concentrations generally ranged from 0.1 µg/L (styrene) to 150 µg/L.

(trichlorethene), vinyl chloride was detected at 860 µg/L. Detection frequencies ranged from 0.4 percent (styrene) to 21 percent (bis(2-ethylhexyl)phthalate (see Tables 5-1 and 5-2).

5.3 ELIMINATION OF METALS AS CONTAMINANTS OF CONCERN IN GROUNDWATER

As shown in Table 5-1 and Appendix A, nearly all metals analyzed for in unfiltered groundwater samples were identified as being above background levels, including aluminum, calcium, iron, potassium, and sodium, which are common rock-forming minerals and not likely to be environmental contaminants in OU6. Most metals failed the formal statistical comparison and had anywhere from 17 to 42 results above the background UTL_{99/99}. Only four metals (cesium, molybdenum, thallium, and tin) were found to be within background levels (see Table A-11).

Because it is unusual, even at hazardous waste sites, to see so many metals above background levels, an evaluation was conducted to ascertain whether the elevated metals concentrations in OU6 groundwater samples were due to factors other than environmental contamination. The evaluation consisted of (1) examining the spatial and temporal distribution of selected metals and (2) examining the relationship of elevated metals concentrations as a whole with organic contamination and with total suspended and total dissolved solids.

The conclusion of the evaluation was that the elevated metals concentrations are not related to environmental contamination but rather to local geochemical conditions and to suspended solids in the groundwater samples. Therefore, metals should not be considered chemicals of concern in groundwater in OU6. Evidence supporting this conclusion is presented below.

- Presence of naturally occurring zones of high manganese and other ions. The results of the background comparison suggest that local geochemical conditions in OU6 are different than those at the background sampling locations. The observances of elevated manganese and of elevated concentrations of iron, cobalt, lead, zinc, copper, nickel, and barium, which

can associate with manganese oxides (Hem 1989), suggest the presence of naturally occurring mineralization in OU6 that is absent in the background sampling locations. Elevated metals concentrations occur in both filtered and unfiltered samples. Recent investigations at the RFETS indicate wide and irregular distribution of dissolved manganese at high concentrations in UHSU groundwater, none of the background wells used for the Background Characterization Report were located in the recently identified areas of elevated manganese (Siders 1994). Therefore, it is probable that the background comparison gives misleading results and that the elevated metals in OU6 groundwater are due to local geochemical conditions.

- Wide distribution of elevated metals and absence of spatial pattern. Elevated concentrations of unfiltered and filtered metals were observed in samples widely distributed across the OU, with no relation to contaminant sources. Figures 5-4 through 5-8 show concentrations of unfiltered metals in wells in several areas of OU6. For example, at wells 41691 and 0486 at Indiana Street (Figure 5-8), 19 metals--aluminum, antimony, barium, beryllium, cadmium, cobalt, chromium, copper, iron, lead, mercury, magnesium, manganese, nickel, potassium, silver, strontium, vanadium, and zinc--exceeded background levels (unfiltered results). However, in the nearest wells upgradient to 41691 and 0486, very few metals in unfiltered samples exceeded background levels. For example, in upgradient well 41091 (Figure 5-5), only barium, potassium, and manganese exceeded background levels. In well 1186, only chromium and magnesium exceeded background levels (Figure 5-5). In upgradient well 3886, only calcium, manganese, sodium, and strontium exceeded background levels (Figure 5-6). As is evident in Figures 5-4 through 5-8, there are numerous other examples of erratic spatial occurrence of samples having ten or more metals with elevated concentrations. The absence of a meaningful spatial pattern (such as concentration gradients) indicates that the occurrence of elevated metals concentrations is not related to contaminant plumes and that they are not associated with identifiable contaminant sources.

- No correlation of elevated metals with VOC contamination Elevated metals concentrations in groundwater can result from the solubilizing effects of organic contamination. However, this does not appear to be true in OU6. Low concentrations of chlorinated solvents and other VOCs such as xylenes and toluene were detected at some sampling locations. Concentrations of VOCs in wells in several areas of OU6 are shown in Figures 5-9 through 5-17. Comparison of metals data shown in Figures 5-4 through 5-8 with organic data shown in Figures 5-9 through 5-17 shows that elevated metals concentrations were observed in some samples from some wells with organic contamination but not in others. Elevated metals concentrations were also observed in many wells with no VOC contamination. Therefore, it is concluded that the metals concentrations are unrelated to organic contamination.
- Absence of temporal pattern The temporal occurrence of concentrations above background UTL_{99/99} was evaluated for selected metals. For example, concentrations of total antimony exceeded the background UTL_{99/99} in 10 OU6 wells at which multiple (4 to 13) sampling rounds were conducted (Figures 5-4 through 5-8). However, in seven of the wells, the UTL_{99/99} was exceeded in only one sampling event, in two wells the UTL_{99/99} was exceeded in two sampling events, and in one well the UTL_{99/99} was exceeded in three sampling events out of ten. This pattern--i.e., temporally isolated occurrences of concentrations in excess of background UTL_{99/99} was found to be true for many analytes. The temporal isolation of elevated concentrations of metals at a single sampling location is inconsistent with an assumption of contamination.
- Strong correlation of elevated metals with Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) Elevated metals concentrations, and the number of elevated metals in a sample, strongly correlate with high TSS and TDS in the samples. TSS and TDS concentrations by well number are listed in Appendix C. TSS concentrations in many samples ranged as high as 1100 to 21,000 mg/L. TDS concentrations ranged as high as 1000 to 7600 mg/L.

These samples had the highest metals concentrations as well. High TSS and TDS appear to be the largest factor contributing to elevated metals concentrations in groundwater samples. High TSS is not a sign of contamination but rather of sample turbidity resulting from well development and sampling procedures. As an example, samples from well 7287, which is located at Trench A (IHSS 166 1), contained numerous elevated metals in several sampling rounds and had TSS ranging as high as 17,000 mg/L (average = 3880 mg/L). Field notes indicate all samples were cloudy, muddy, or colored. On the other hand, samples from well B206489, which is adjacent to well 7287 (see Figure 5-4), had TSS ranging from 9 to 81 mg/L, and had only a single occurrence of a metal result exceeding background UTL. Field notes indicate all but one sample were clear.

As examples of the correlation of elevated metals to TSS and TDS, Figures 5-1 through 5-3 show scatterplots of aluminum, arsenic, and barium to TSS and TDS. These three metals are used as examples because of their high relative risk at the maximum concentrations found in OU6.

It is concluded that elevated metals concentrations in OU6 groundwater samples are related to suspended solids in the sample and to naturally occurring geochemical characteristics such as high manganese zones. Metals are therefore eliminated from further consideration as contaminants of concern in groundwater in OU6.

5.4 ELIMINATION OF BIS(2-ETHYLHEXYL)PHTHALATE, CESIUM-137, AND STRONTIUM-89,90 AS CHEMICALS OF CONCERN IN GROUNDWATER

Review of the analytical results and occurrence of bis(2-ethylhexyl)phthalate, cesium-137, and strontium-89,90 in groundwater indicates that these analytes should not be included in the selection of OU-wide chemicals of concern in groundwater. The evidence supporting this conclusion is presented below.

Bis(2-ethylhexyl)phthalate Bis(2-ethylhexyl)phthalate is a common field and laboratory contaminant because it is a constituent of plastic products used in sampling and analysis. This compound was detected in 3 of 14 groundwater samples submitted for SVOC analyses and it is the only SVOC detected in the samples, except for one result for diethylphthalate. All results were estimated values below the quantitation limit of 0.010 mg/L. The three positive results were temporally isolated (detected in only one of multiple sampling rounds) and were from spatially distant wells.

Bis(2-ethylhexyl)phthalate Detections in Groundwater

Well No	Location	Sample Date	Concentration, mg/L
77492	IHSS 143 (Old Outfall)	3/22/93	ND
		4/21/93	ND
		8/4/93	0.008 J
41691	Indiana Street	12/7/91	0.003 J
		4/1/92	ND
41091	North Walnut Creek, downgradient of Pond A-4	12/20/91	ND
		3/17/92	0.004 J
		8/13/93	ND

ND = Not detected (quantitation limit = 0.010 mg/L)

The few detections are temporally and spatially isolated, and the data do not support an assumption of contamination. Therefore, this compound is eliminated from further consideration as a contaminant in groundwater.

Cesium-137 Results for cesium-137 in unfiltered groundwater samples were not found to be significantly different than background levels according to the four formal statistical tests described in Appendix A. However, 2 results out of 68 exceeded the background UTL_{99/99} of 1.065 pCi/L. 1.8 pCi/L in well 1786 upgradient of the A series ponds and 4.5 pCi/L at well 1286 in pond A-3. Consequently, this analyte was identified as a potential chemical of concern. However, the two exceedances of the background UTL are temporally isolated events and all other results at these locations were within background range.

Analytical results for cesium-137 at wells 1786 and 1286 are summarized below

Cesium-137

Temporal Evaluation at Wells with Exceedances of Background UTL_{99/99}

Well	Sample Date	Activity, pCi/L
1786	10/10/91	0.28
	11/14/91	0.56
	1/20/92	0.40
	6/11/92	0.53
	7/12/93	1.82
1286	6/20/91	0.63
	1/10/92	0.19
	5/14/92	4.50

Background mean plus 2 standard deviation = 0.782 pCi/L, background maximum = 1.16 pCi/L, background UTL_{99/99} = 1.065 pCi/L

Because only 2 results out of 68 exceeded the background range and because they were temporally isolated events, cesium-137 is not considered a contaminant in groundwater, and it is not evaluated further.

Strontium-89,90 Only three groundwater samples were analyzed for strontium-89,90. The results were 0.19, 1.10, and 1.22 pCi/L. These results are within or slightly above background levels (the background mean plus two standard deviations is 0.95 pCi/L, the background maximum is 1.12 pCi/L (n = 32), and the background UTL_{99/99} is 1.154 pCi/L). The three OU6 samples were collected from spatially distant wells (well 2691 upgradient of the B series ponds, well 1186 downgradient of pond A-4, and well 486 at Indiana Street). Because the sample size is so small and because the OU6 levels are so close to background levels, this analyte is not included in the determination of OU-wide chemicals of concern in groundwater.

5.5 CONCENTRATION/TOXICITY SCREENS

Concentration/toxicity screens for organic contaminants and radionuclides are presented in Tables 5-3 through 5-5. With the exception of the analytes discussed in Section 5.4, all organic analytes detected at a frequency of 5 percent or greater and radionuclides identified as above background levels were included in the screens.

All analytes that contribute at least 1 percent of the total risk factor are retained as OU-wide chemicals of concern in groundwater for quantitative risk assessment. Chemicals of concern for groundwater are listed below and in Table 5-6.

OU-Wide Chemicals of Concern Groundwater

Chemical	Maximum Result (mg/L or pCi/L)
Chloroform	0.008
Methylene chloride	0.032
Tetrachloroethene	0.013
Trichloroethene	0.150
Nitrate	1760
Plutonium-239, 240	3.65
Americium-241	3.2
Radium-226	8.8

The distribution of the organic chemicals of concern in groundwater is shown in Figures 5-9 through 5-17. The maximum concentrations of volatile organics are relatively low (<0.15 mg/L) and the maximum frequency of detection was 15 percent (Table 5-1). Therefore, organic contamination of groundwater in OU6 is considered minimal.

The distribution of elevated concentrations of radionuclide chemicals of concern in groundwater is shown in Figures 5-18 through 5-21 (results above background mean plus two standard deviations are shown) Most elevated results were measured in samples collected at the two wells at Indiana Street (well 486 and well 41691, Figure 5-21)

Nitrates were detected in wells upgradient of the A series ponds They are believed to be associated with the solar ponds, which are upgradient of OU6

5 6 RISK-BASED EVALUATION OF INFREQUENTLY DETECTED COMPOUNDS

Maximum concentration of 13 VOCs (detected at <5 percent frequency) were compared to values equivalent to 1000 times the chemical-specific RBCs The RBCs were calculated assuming residential use of groundwater and are used to identify special-case chemicals of concern that could pose a health risk if long-term exposure were to occur to maximum concentrations in a highly localized area The screen is discussed in Appendix B and the results for groundwater are presented in Table B-3

Vinyl chloride was the only chemical detected at low frequency that exceeded the 1000 times RBC value Vinyl chloride will be retained for further evaluation as a special-case chemical of concern in groundwater

TABLE 5-1
ROCKY FLATS OU6
ORGANIC COMPOUNDS AND TOTAL METALS DETECTED AT
5% OR GREATER FREQUENCY
UHSU GROUNDWATER

Chemical	Maximum Detected Concentration (mg/L)	Detection Frequency %	Inorganic PCOC ⁽¹⁾
Organic Compounds			
1,1,1-Trichloroethane	0.012	9	
1,1-Dichloroethane	0.062	9	
1,2-Dichloroethene	0.074	11	
1,2-Dichloroethene, cis	0.0007	6	
Acetone	0.027	5	
Bis(2-ethylhexyl)phthalate	0.008	21	
Chloroform	0.008	9	
Diethyl phthalate	0.002	7	
Methylene chloride	0.032	12	
Tetrachloroethene	0.013	15	
Toluene	0.016	6	
Trichloroethene	0.15	14	
Metals			
Aluminum	456	95	Yes
Antimony	0.194	16	Yes
Arsenic	0.018	52	Yes
Barium	5.06	98	Yes
Beryllium	0.032	30	Yes
Cadmium	0.0329	26	Yes
Chromium	0.58	75	Yes
Cobalt	0.228	45	Yes
Copper	6.43	54	Yes
Lead	0.254	73	Yes
Lithium	0.456	93	Yes
Manganese	6.2	94	Yes
Mercury	0.0015	10	Yes
Molybdenum	0.0295	27	No
Nickel	1.07	66	Yes
Selenium	0.475	58	Yes
Silver	3.04	20	Yes
Strontium	6.96	100	Yes
Thallium	0.0027	5	No
Tin	0.267	19	No
Vanadium	0.754	74	Yes
Zinc	8	83	Yes

(1) Based on background comparison (Appendix A)

TABLE 5-2
ROCKY FLATS OU6
ORGANIC COMPOUNDS AND TOTAL METALS DETECTED AT
LESS THAN 5% FREQUENCY
UHSU GROUNDWATER

Chemical	Maximum Detected Concentration (mg/L)	Detection Frequency %	Inorganic PCOC ⁽¹⁾
Organic Compounds			
1,1-Dichloroethene	0.005	1	
1,2-Dichloroethane	0.002	1	
1,2-Dichloroethene trans	0.009	2	
1,2,4-Trimethylbenzene	0.0002	3	
2-Butanone	0.001	1	
2-Hexanone	0.005	0.4	
4-Methyl-2-pentanone	0.002	1	
Benzene	0.003	3	
Carbon disulfide	0.004	1	
Carbon tetrachloride	0.008	4	
Chloromethane	0.00025	0.4	
Ethylbenzene	0.001	2	
Styrene	0.00011	0.4	
Vinyl chloride	0.86	3	
Xylenes (total)	0.014	4	
Metals			
Cesium	0.15	2	No

⁽¹⁾ Based on background comparison (Appendix A)

TABLE 5-3
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
UHSU GROUNDWATER
NONCARCINOGENS

Chemical	Maximum Detected Conc (mg/L)	Inhalation RfD	Oral RfD	Risk Factor	Risk Index	% of Total Risk Factor
Nitrate	1760	n/a	1.6E+00	1.1E+03	9.9E-01	98.9
1,2-Dichloroethene	0.074	n/a	9.0E-03	8.2E+00	7.4E-03	0.7
Tetrachloroethene	0.013	n/a	1.0E-02	1.3E+00	1.2E-03	0.1
Chloroform	0.008	n/a	1.0E-02	8.0E-01	7.2E-04	0.1
1,1-Dichloroethane	0.062	1.4E-01	1.0E-01	6.2E-01	5.6E-04	0.1
Methylene chloride	0.032	9.0E-01	6.0E-02	5.3E-01	4.8E-04	0.0
Acetone	0.027	n/a	1.0E-01	2.7E-01	2.4E-04	0.0
Toluene	0.016	1.1E-01	2.0E-01	1.5E-01	1.3E-04	0.0
cis-1,2-Dichloroethene	0.0007	n/a	1.0E-02	7.0E-02	6.3E-05	0.0
Diethyl phthalate	0.002	n/a	8.0E-01	2.5E-03	2.2E-06	0.0
Total Risk Factor				1.1E+03		

RfDs are in units of mg/kg-day
n/a = not available

**TABLE 5-4
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
UHSU GROUNDWATER
CARCINOGENS**

Chemical	Maximum Detected Conc (mg/L)	Inhalation Slope Factor	Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
Trichloroethene	0.15	6.0E-03	1.1E-02	1.7E-03	5.1E-01	51.5
Tetrachloroethene	0.013	2.0E-03	5.2E-02	6.8E-04	2.1E-01	21.1
Chloroform	0.008	8.0E-02	6.1E-03	6.4E-04	2.0E-01	20.0
Methylene chloride	0.032	1.6E-03	7.5E-03	2.4E-04	7.5E-02	7.5
Total Risk Factor				3.2E-03		

Slope factors are in units of 1/(mg/kg-day)

n/a = not available

TABLE 5-5
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
UHSU GROUNDWATER
RADIONUCLIDES

Chemical	Maximum Activity (pCi/L)	Inhalation Slope Factor	Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
Radium-226	8.8	3.0E-09 *	1.2E-10	1.1E-09	4.0E-01	39.6
Plutonium-239,240	3.65	3.8E-08 *	2.3E-10	8.4E-10	3.2E-01	31.5
Americium-241	3.2	3.2E-08 *	2.4E-10	7.7E-10	2.9E-01	28.8
Total Risk Factor				2.7E-09		

Slope factors are in units of 1/pCi

* Inhalation of radionuclides from groundwater is an incomplete pathway. Therefore oral toxicity factors were used in the screen.

TABLE 5-6
ROCKY FLATS OU6
CHEMICALS OF CONCERN
UHSU GROUNDWATER

OU-Wide	Special Case ¹
Chloroform	Vinyl chloride
Methylene chloride	
Tetrachloroethene	
Trichloroethene	
Nitrate	
Plutonium-239 240	
Americium-241	
Radium-226	

¹ See Appendix B

Figure 5-1
Rocky Flats OU6
Scatter Plot of Unfiltered ALUMINUM Vs TSS
UHSU Groundwater

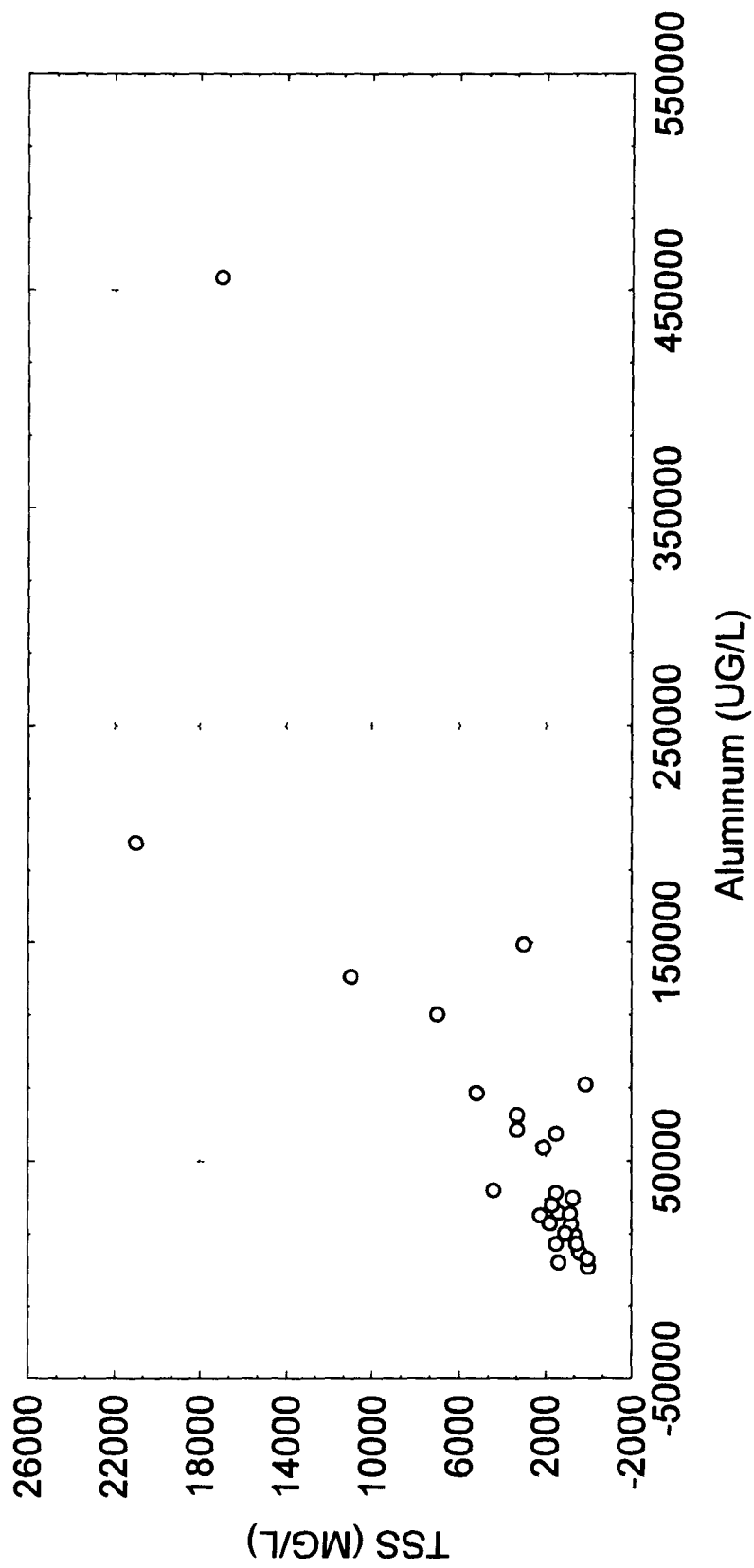


Figure 5-2
Rocky Flats OU6
Scatter Plot of Unfiltered ARSENIC Vs TSS
UHSU Groundwater

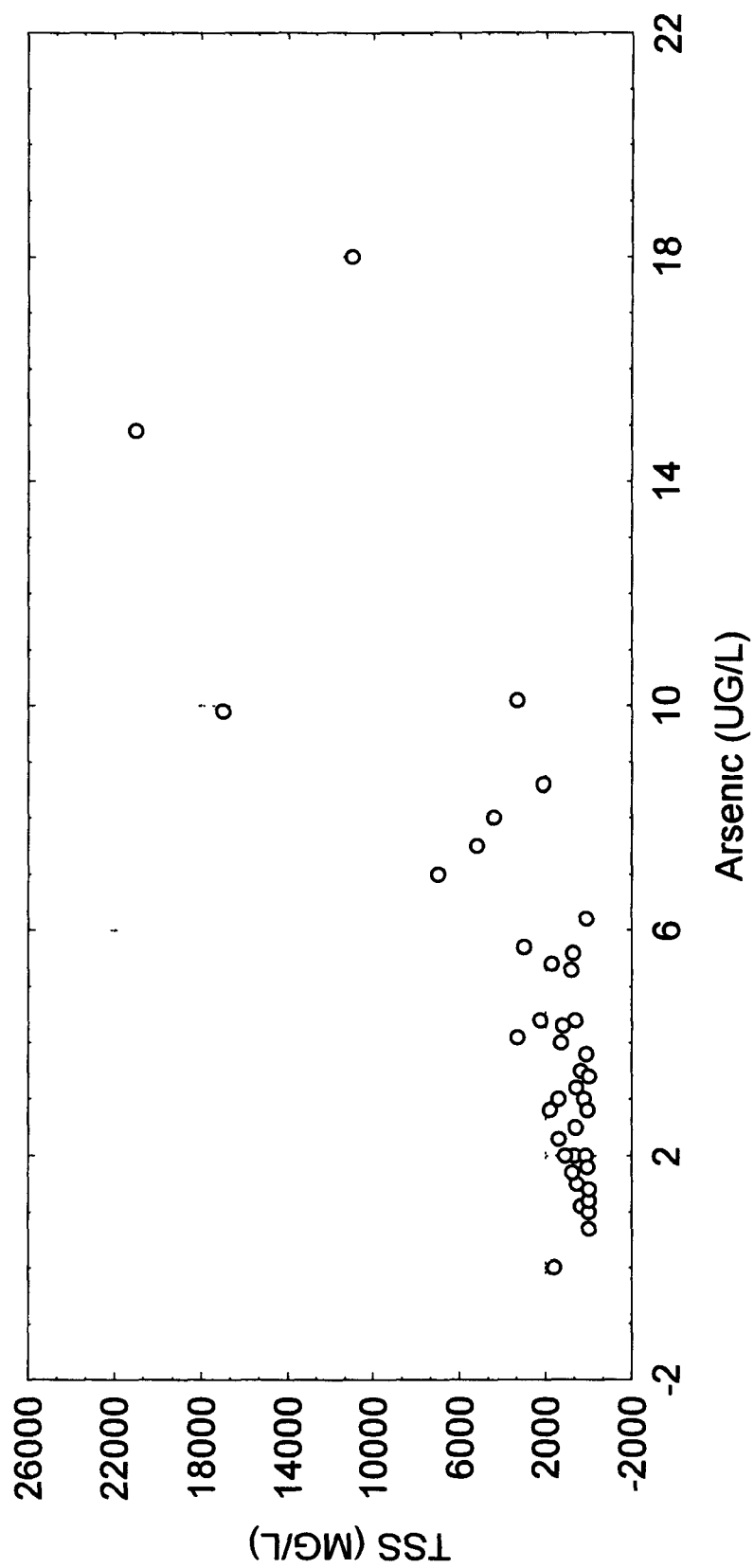
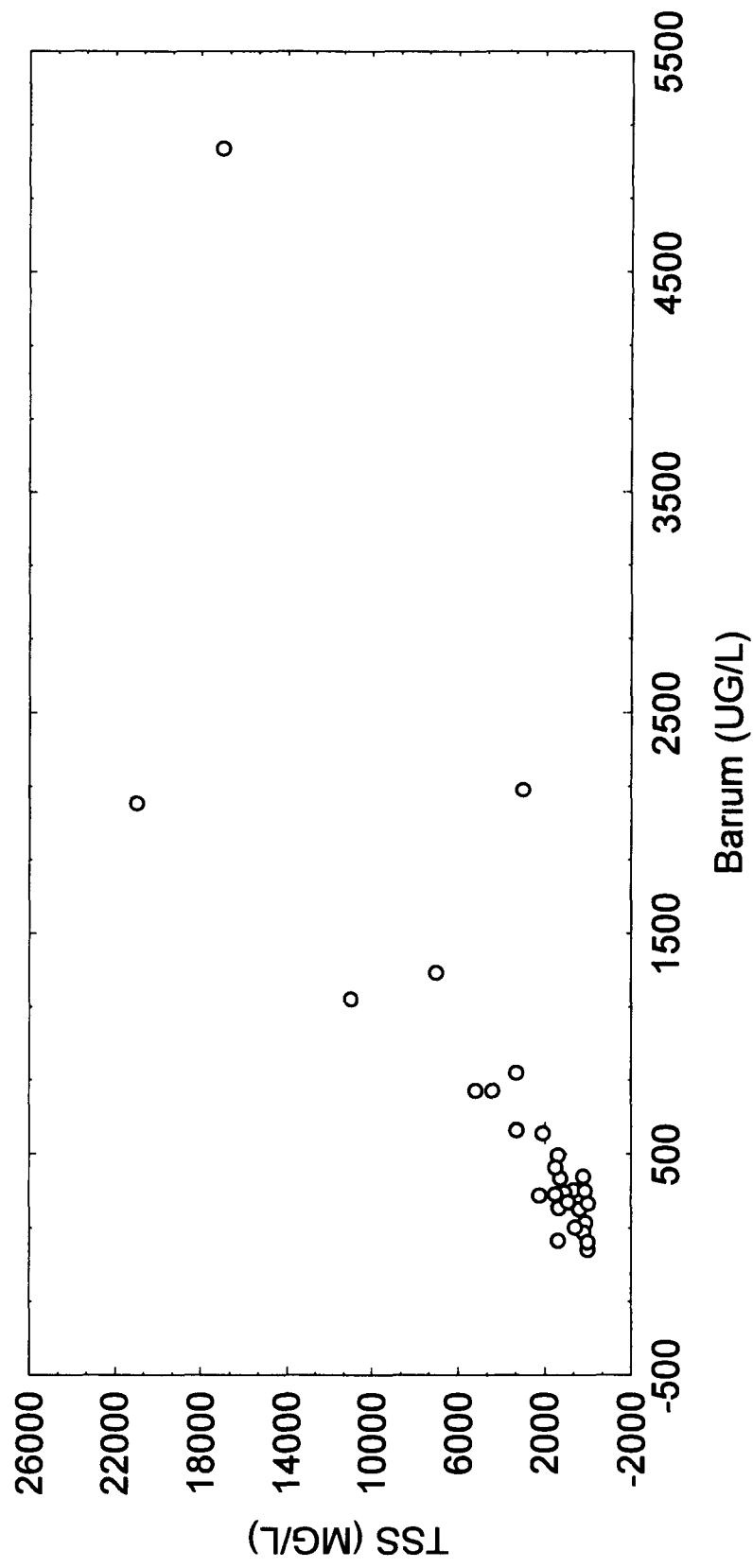


Figure 5-3
Rocky Flats OU6
Scatter Plot of Unfiltered BARIUM Vs TSS
UHSU Groundwater



6 0 POND SEDIMENT CHEMICALS OF CONCERN

6 1 POND SEDIMENT DATA SET

Wet sediment samples were collected in the A and B series ponds in the Walnut Creek drainage, including the terminal pond at Walnut Creek and Indiana Street. Collectively the ponds are IHSS 142. The A series ponds along North Walnut Creek are numbered IHSS 142 1 through 142 4. The B series ponds along South Walnut Creek are numbered IHSS 142 5 through 142 9. The terminal pond is IHSS 142 12. Pond locations are shown in Figure 1-1. Approximately 50 samples were collected and analyzed for metals, radionuclides, volatile and semivolatile organic compounds, and pesticides/PCBs. The sampling and analytical program for pond wet sediments (IHSS 142) is summarized in Tables 2-1 and 2-2.

6 2 BACKGROUND COMPARISON AND FREQUENCY OF DETECTION

Tables 6-1 and 6-2 summarize the maximum detected concentrations and detection frequencies for organic compounds and metals and the results of the background comparison for metals in the pond sediment samples. Background data from seeps/springs reported in the Background Geochemical Characterization Report (DOE 1993) were used for comparison to pond sediment data. Seep/spring background data were preferred to background stream sediment data for this comparison because of the similarity in flow regime (long residence time) in the seeps and ponds. The statistical comparisons of inorganic results to background data are presented in detail in Appendix A.

Radionuclides are assumed to be detected at 100 percent frequency (that is both negative and positive results are included in the data set). Radionuclides above background levels are listed in the concentration/toxicity screen in Table 6-5.

Analytes above background levels that were detected at 5 percent or greater detection frequency were included in concentration/toxicity screens to select OU-wide chemicals of

concern, with the exception of manganese, which is considered to be naturally occurring as explained in Section 6.3

6.3 EXCLUSION OF MANGANESE AS A CHEMICAL OF CONCERN IN POND SEDIMENT

Manganese was identified as a potential chemical of concern in pond sediment because it failed the Gehan test when compared to background seep/spring data (see Table A-21) (The Gehan test ranks the values in the combined background and site data sets). However, further review of the data indicates that manganese should not be considered a contaminant in this medium. Mean and maximum concentrations of manganese in background and OU6 pond sediments are summarized in the table below.

Manganese in Background and OU6 Sediment Samples

Location	Sample Size	Mean mg/kg	Maximum mg/kg	Std Dev mg/kg
Background	20	318	1740	437
OU6	57	283	558	86

Histograms and box plots comparing background and OU6 sediment data are shown in Figures 6-13 and 6-14. Review of the histograms shows that the majority of the OU6 pond sediment data falls between 177 and 400 mg/kg, with a maximum of 558 mg/kg, and that these values fall well within the range of values for the background data. In fact, the background data set includes higher values than detected in pond sediment. The box plot (Figure 6-14) also demonstrates that the OU6 measurements are similar to background. Furthermore, no OU6 measurement exceeded the background mean plus two standard deviations of 1192 mg/kg, which is the CDPHE criterion for identifying source areas of contamination. In addition, manganese is not a contaminant in surface soil, subsurface soil, or groundwater, and therefore it would not be expected to be a contaminant in sediment.

Concentrations of manganese in sediment are comparable to those measured in background and OU6 surface soils samples (Figure 6-15)

6.4 CONCENTRATION/TOXICITY SCREENS

Concentration/toxicity screens for pond sediments are presented in Tables 6-3 through 6-5. All analytes that contribute at least 1 percent of the total risk factor are retained as OU-wide chemicals of concern for quantitative risk assessment.

Chemicals of concern are listed below and in Table 6-6:

OU-Wide Chemicals of Concern Pond Sediments

Benzo(a)pyrene
Benzo(b)fluoranthene
Bis(2-ethylhexyl)phthalate
Aroclor-1254
Antimony
Manganese
Silver
Vanadium
Zinc
Plutonium-239,240
Americium-241

The distribution of organic chemicals of concern in pond sediments is shown in Figures 6-1 through 6-6. PAHs and PCBs were widely detected in pond sediments. Bis(2-ethylhexyl)phthalate was detected in low concentrations in the A series ponds and in higher concentrations in the B series ponds.

Concentrations of metal chemicals of concern above the background mean plus two standard deviations are shown in Figures 6-7 through 6-9. Silver and zinc were detected in the highest

concentrations in the B series ponds, especially pond B-1. Antimony was identified as a potential chemical of concern because 1 sample out of 57 (68 mg/kg in pond B-3) exceeded the background UTL_{99/99} of 55 mg/kg, however, antimony did not exceed background by any of the four formal statistical tests (see Appendix A, Table A-21). Therefore, although antimony at its maximum detected concentration represented 65 percent of the total risk factor (Table 6-3), it is questionable whether antimony should be considered an OU-wide chemical of concern. However, it is retained as a chemical of concern because it met the following criteria for selecting chemicals of concern: it was detected at greater than 5 percent frequency, it exceeded background by the UTL comparison, and the elevated concentration is located in an IHSS (i.e., cannot be excluded on the basis of spatial or temporal evaluation).

Plutonium-239,240 and americium-241 are also widely detected in pond sediments, especially in the B series ponds (Figures 6-10 through 6-12, activities above background mean plus two standard deviations are shown).

Chemicals of potential concern in pond sediments that do not have EPA-established toxicity factors are 2-methylnaphthalene, benzo(ghi)perylene, phenanthrene, dibenzofuran, and copper. Because of the lack of toxicity factors for these chemicals, they cannot be evaluated in a toxicity- or risk-based screen to select chemicals of concern. However, their potential contribution to overall risk will be evaluated qualitatively in the risk assessment for OU6.

6.5 RISK-BASED EVALUATION OF INFREQUENTLY DETECTED COMPOUNDS

Maximum concentrations of ten VOCs, SVOCs, and pesticides/PCBs (detected at <5 percent frequency) were compared to values equivalent to 1000 times chemical-specific RBCs (DOE 1994b). Although these chemicals were detected in pond sediment where exposure potential is limited, the RBCs used in this screening evaluation were calculated assuming long-term residential exposure. This approach is extremely conservative, since it assumes a daily exposure to chemicals in pond sediment, including inhalation of particulate matter. The comparison to 1000 times the RBCs is used to identify special-case chemicals of concern, that

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is infrequently detected chemicals that could pose a health risk if long-term exposure were to occur to the maximum concentration. The screen is discussed in Appendix B and the results for pond sediment are presented in Table B-4.

None of the chemicals detected at low frequency in pond sediments exceeded 1000 times the RBC. Therefore, no special-case chemicals of concern were identified in pond sediments.

TABLE 6-1
ROCKY FLATS OU6
ORGANIC COMPOUNDS AND METALS DETECTED AT
5% OR GREATER FREQUENCY
POND SEDIMENT

Chemical	Maximum Detected Concentration (mg/kg)	Detection Frequency %	Inorganic PCOC ? ⁽¹⁾
Organic Compounds			
2-Butanone	0 13	53	
Acenaphthene	0 59	9	
Acetone	3 3	94	
Anthracene	0 8	20	
Aroclor-1254	10	44	
Benzene	0 01	6	
Benzo(a)anthracene	1 1	38	
Benzo(a)pyrene	0 87	41	
Benzo(b)fluoranthene	3 1	45	
Benzo(g,h,i)perylene	0 66	11	
Benzo(k)fluoranthene	1	32	
Benzoic acid	4 6	27	
Bis(2-ethylhexyl)phthalate	88	91	
Butyl benzylphthalate	0 12	5	
Chrysene	1 9	52	
Di-n-octyl phthalate	0 25	11	
Fluoranthene	3 5	66	
Indeno(1,2,3-cd)pyrene	0 66	14	
Methylene chloride	8 3	92	
Phenanthrene	2 6	54	
Pyrene	3 8	66	
Toluene	1 1	90	
Metals			
Aluminum	27400	100	No
Antimony	68 5	39	Yes
Arsenic	10 2	100	No
Barium	254	100	No
Beryllium	15 2	98	No
Cadmium	9 9	39	No
Cesium	5 8	93	No
Chromium	96 1	100	Yes
Cobalt	15 5	100	Yes

**TABLE 6-1
(CONCLUDED)**

Chemical	Maximum Detected Concentration (mg/kg)	Detection Frequency %	Inorganic PCOC ? ⁽¹⁾
Copper	125	100	Yes
Lead	155	100	No
Lithium	16.6	98	No
Manganese	558	100	Yes
Mercury	1.5	43	No
Nickel	58.1	70	No
Selenium	1.9	5	No
Silver	345	39	Yes
Strontium	307	100	No
Thallium	0.85	39	No
Vanadium	62.7	100	Yes
Zinc	1270	100	Yes

(1) Based on background comparison (Appendix A)

TABLE 6-2
ROCKY FLATS OU6
ORGANIC COMPOUNDS AND METALS DETECTED AT
LESS THAN 5% FREQUENCY
POND SEDIMENT

Chemical	Maximum Detected Concentration (mg/kg)	Detection Frequency %	Inorganic PCOC ? ⁽¹⁾
Organic Compounds			
1,2,4-Trichlorobenzene	0.13	2	
2-Methylnaphthalene	0.17	2	
4-Methyl-2-pentanone	0.006	2	
Aldrin	0.054	2	
Aroclor-1260	0.86	4	
Dibenzo(a,h)anthracene	0.15	2	
Dibenzofuran	0.18	2	
Fluorene	0.46	4	
gamma-BHC (Lindane)	0.025	2	
Heptachlor	0.039	1	
Naphthalene	0.39	2	
Phenol	0.29	4	
Metals			
Tin	39.5	2	No

⁽¹⁾ Based on background comparison (Appendix A)

TABLE 6-3
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
POND SEDIMENT
NONCARCINOGENS

Chemical	Maximum Detected onc (mg/kg)	Inhalation RfD	Oral RfD	Risk Factor	Risk Index	% of Total Risk Factor
Antimony	68.5	n/a	4.0E-04	1.7E+05	6.6E-01	66.2
Silver	345	n/a	5.0E-03	6.9E+04	2.7E-01	26.7
Vanadium	62.7	n/a	7.0E-03	9.0E+03	3.5E-02	3.5
Bis(2-ethylhexyl)phthal	88	n/a	2.0E-02	4.4E+03	1.7E-02	1.7
Zinc	1270	n/a	3.0E-01	4.2E+03	1.6E-02	1.6
Cobalt	15.5	n/a	6.0E-02	2.6E+02	1.0E-03	0.1
Methylene chloride	8.3	9.0E-01 *	6.0E-02	1.4E+02	5.3E-04	0.1
Pyrene	3.8	n/a	3.0E-02	1.3E+02	4.9E-04	0.0
Chromium	96.1	n/a	1.0E+00	9.6E+01	3.7E-04	0.0
Fluoranthene	3.5	n/a	4.0E-02	8.8E+01	3.4E-04	0.0
Acetone	3.3	n/a	1.0E-01	3.3E+01	1.3E-04	0.0
Di-n-octylphthalate	0.25	n/a	2.0E-02	1.3E+01	4.8E-05	0.0
Acenaphthene	0.59	n/a	6.0E-02	9.8E+00	3.8E-05	0.0
Toluene	1.1	1.1E-01 *	2.0E-01	5.5E+00	2.1E-05	0.0
Anthracene	0.8	n/a	3.0E-01	2.7E+00	1.0E-05	0.0
Benzoic acid	4.6	n/a	4.0E+00	1.2E+00	4.4E-06	0.0
Butyl benzylphthalate	0.12	n/a	2.0E-01	6.0E-01	2.3E-06	0.0
2-Butanone	0.13	3.0E-01 *	6.0E-01	2.2E-01	8.4E-07	0.0
Total Risk Factor				2.6E+05		

RfDs are in units of mg/kg-day

n/a = not available

* Inhalation is an incomplete pathway because pond sediments are assumed to remain saturated and are not released to air. Therefore, oral toxicity factors were used in this screen.

TABLE 6-4
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
POND SEDIMENT
CARCINOGENS

Chemical	Maximum Detected Conc (mg/kg)	Inhalation Slope Factor	Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
Aroclor-1254	10	n/a	7 7E+00	7 7E+01	8 7E-01	87 1
Benzo(a)pyrene	0 87	n/a	7 3E+00	6 4E+00	7 2E-02	7 2
Benzo(b)fluoranthene	3 1	n/a	7 3E-01	2 3E+00	2 6E-02	2 6
Bis(2-ethylhexyl)phthalate	88	n/a	1 4E-02	1 2E+00	1 4E-02	1 4
Benzo(a)anthracene	1 1	n/a	7 3E-01	8 0E-01	9 1E-03	0 9
Indeno(1,2,3-cd)pyrene	0 66	n/a	7 3E-01	4 8E-01	5 4E-03	0 5
Chrysene	1 9	n/a	7 3E-02	1 4E-01	1 6E-03	0 2
Benzo(k)fluoranthene	1	n/a	7 3E-02	7 3E-02	8 3E-04	0 1
Methylene chloride	8 3	1 6E-03	*	7 5E-03	6 2E-02	7 0E-04
Benzene	0 01	2 9E-02	*	2 9E-02	2 9E-04	3 3E-06
Total Risk Factor				8 8E+01		

Slope factors are in units of 1/(mg/kg-day)

n/a = not available

* Inhalation is an incomplete pathway because pond sediments are assumed to remain saturated and contaminants are not released to air. Therefore, oral toxicity factors were used in this screen.

TABLE 6-5
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
POND SEDIMENT
RADIONUCLIDES

Chemical	Maximum Activity (pCi/g)	Inhalation Slope Factor		Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
Plutonium-239,240	1174	3.8E-08	*	2.3E-10	2.7E-07	8.3E-01	82.6
Americium-241	230.53	3.2E-08	*	2.4E-10	5.5E-08	1.7E-01	16.9
Uranium-238	26,445	5.2E-08	*	2.8E-11	7.4E-10	2.3E-03	0.2
Uranium-233,234	15,935	2.6E-08	*	1.6E-11	2.5E-10	7.8E-04	0.1
Uranium-235	0.854	2.5E-08	*	1.6E-11	1.4E-11	4.2E-05	0.0
Radium-226	1.25	3.0E-09	*	1.2E-10	1.5E-10	4.6E-04	0.0
Radium-228	2.3	6.6E-10	*	1.0E-10	2.3E-10	7.0E-04	0.1
Strontium-89,90	1.8	6.2E-11	*	3.6E-11	6.5E-11	2.0E-04	0.0
Total Risk Factor					3.3E-07		

Slope factors are in units of 1/pCi

- Inhalation is an incomplete pathway because pond sediments are assumed to remain saturated and contaminants are not released to air. Therefore, oral toxicity factors were used in the screen.

TABLE 6-6
ROCKY FLATS OU6
CHEMICALS OF CONCERN
POND SEDIMENT

OU-Wide	
	Aroclor-1254
	Benzo(a)pyrene
	Benzo(b)fluoranthene
	Bis(2-ethylhexyl)phthalate
	Antimony
	Silver
	Vanadium
	Zinc
	Americium-241
	Plutonium-239,240

FIGURE 6-13

HISTOGRAMS FOR MANGANESE IN BACKGROUND SEEP/SPRING AND OU6 POND SEDIMENTS

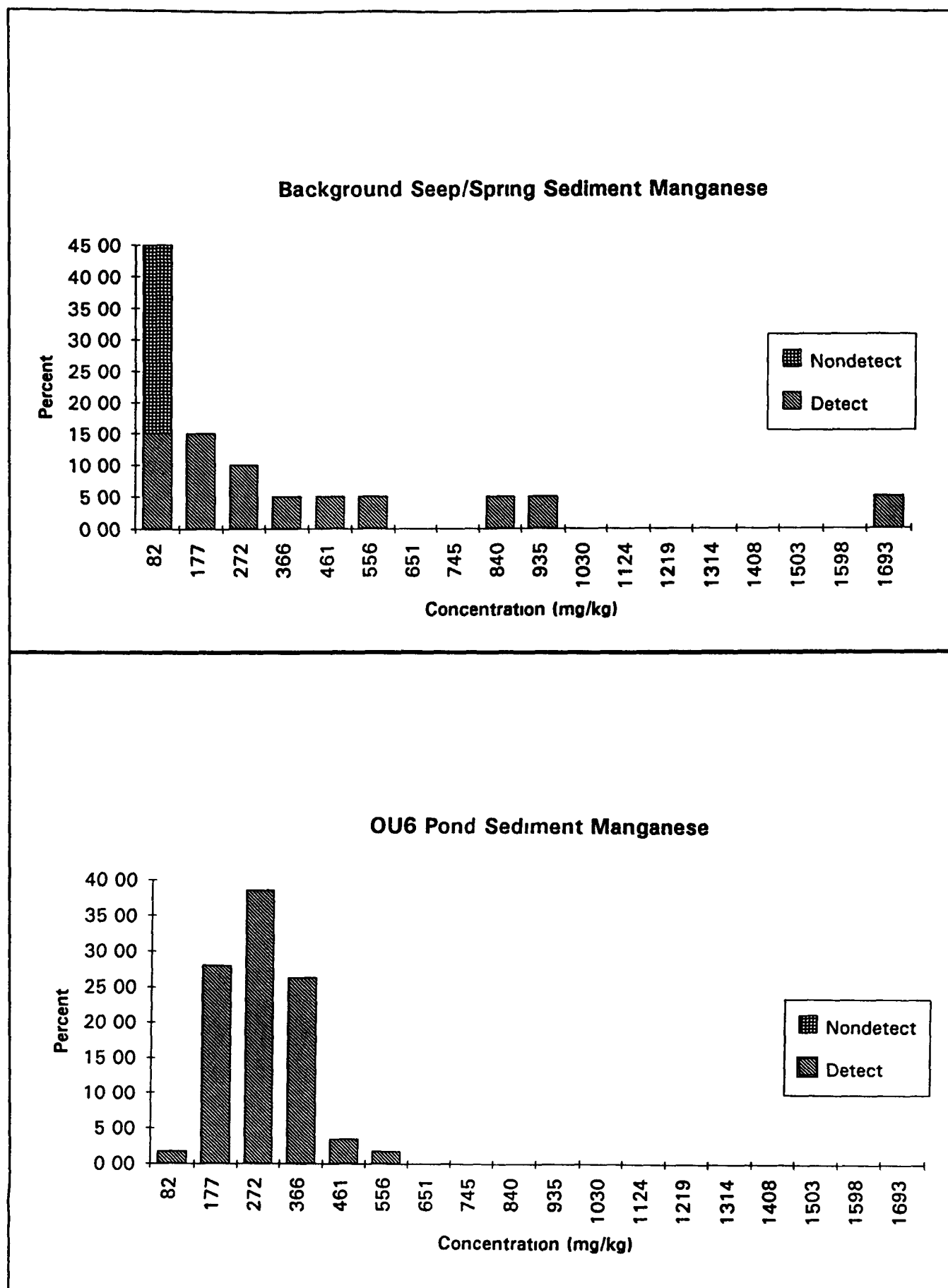


FIGURE 6-14
BOX PLOTS FOR MANGANESE IN BACKGROUND SEEP/SPRING AND OU6 POND SEDIMENTS

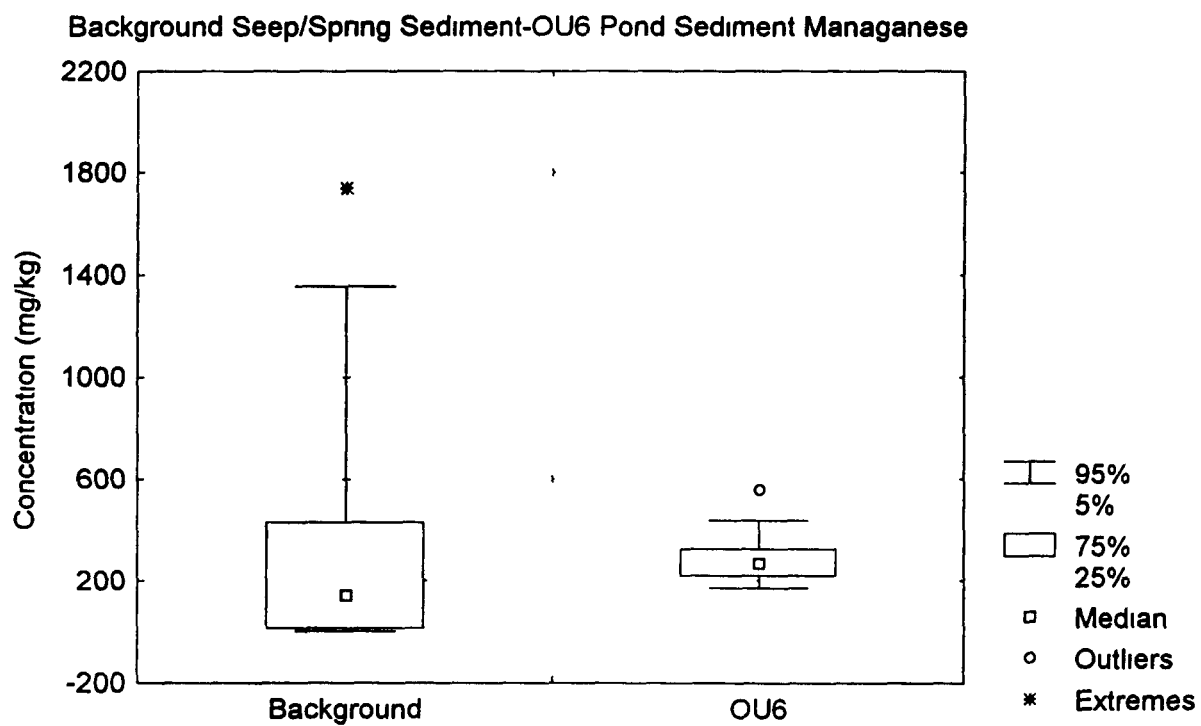
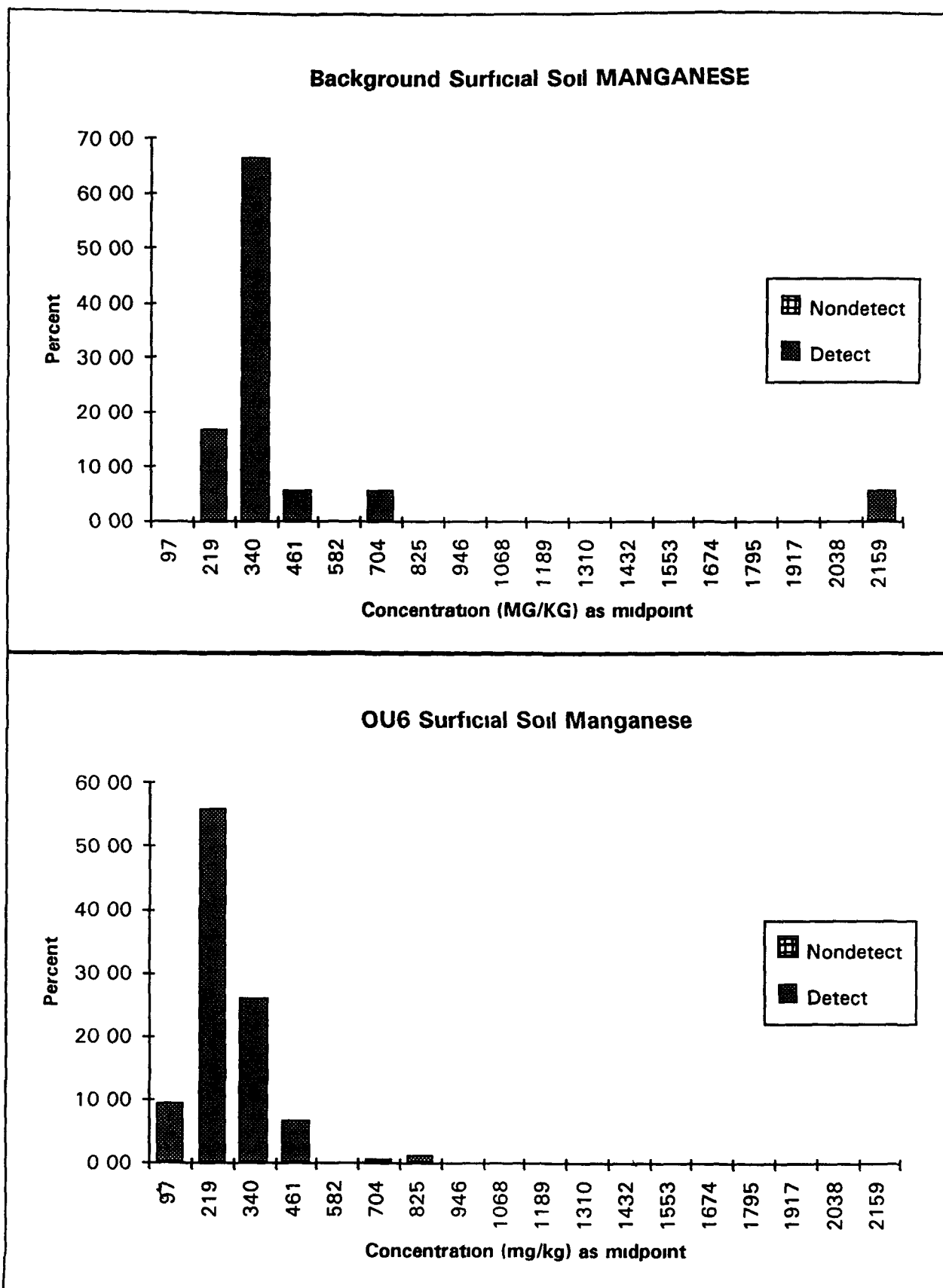


FIGURE 6-15
HISTOGRAMS FOR MANGANESE IN BACKGROUND AND OU6 SURFACE SOIL



7 0 POND SURFACE WATER CHEMICALS OF CONCERN

7 1 POND SURFACE WATER DATA SET

Approximately 50 surface water samples were collected in the A and B series ponds in the Walnut Creek drainage, including the terminal pond at Walnut Creek and Indiana Street. Samples were analyzed for metals, radionuclides, and volatile and semivolatile organic compounds. The sampling and analytical program for pond surface water (IHSS 142) is summarized in Tables 2-1 and 2-2.

7 2 BACKGROUND COMPARISON AND FREQUENCY OF DETECTION

Tables 7-1 and 7-2 summarize the maximum detected concentrations and detection frequencies for organic compounds and metals and the results of the background comparison for metals in pond surface water. Background data from seeps/springs reported in the Background Geochemical Characterization Report (DOE 1993) were used for comparison to pond surface water data. Seep/spring background data were preferred to background stream data for this comparison because of the similarity in flow regime (long residence time) in the seeps and ponds. The statistical comparisons of metals and radionuclide results to background data are presented in detail in Appendix A.

Analytes above background levels that were detected at 5 percent or greater detection frequency were included in concentration/toxicity screens to select OU-wide chemicals of concern, with the exception of uranium isotopes. Uranium in pond surface water is considered to be naturally occurring, for the reasons presented in Section 7.3. Compounds detected at less than 5 percent frequency were evaluated in the risk-based RBC screen to identify special-case chemicals of concern.

7.3 EXCLUSION OF URANIUM ISOTOPES AS CHEMICALS OF CONCERN IN POND SURFACE WATER

Uranium isotopes (U-233,234, U-235, and U-238) were the only radionuclides in unfiltered pond water that exceeded background levels (based on comparison to seep/spring water, Table A-31). The detections of uranium isotope activities above the background mean plus two standard deviations are shown in Figures 7-5 and 7-6. The uranium isotopes in pond water are likely to be naturally occurring. The ratio of U-233,234 to U-238 activity is close to one in naturally occurring uranium (DOE 1992c). In all ponds except B-4 (where non-detect results for U-238 prevented an adequate analysis), the ratio of U-233,234 activity to U-238 activity ranged from 0.7 to 1.3 (overall average = 0.99). Because the ratios in individual ponds and the overall average are so close to one, it is concluded that the uranium detected in pond water samples results from naturally occurring uranium in the environment. Furthermore, uranium isotopes did not exceed background levels in OU6 surface soil or in groundwater, which supports a conclusion that these isotopes are not contaminants but rather are naturally occurring. Therefore, uranium isotopes are eliminated from further evaluation as chemicals of concern.

7.4 CONCENTRATION/TOXICITY SCREENS

Concentration/toxicity screens for organic compounds detected in pond surface water are presented in Tables 7-3 and 7-4. All analytes that contribute at least 1 percent of the total risk factor are retained as OU-wide chemicals of concern for quantitative risk assessment. Chemicals of concern are listed below and in Table 7-5.

OU-Wide Chemicals of Concern Pond Surface Water

Acetone
Chloroform
1,2-Dichloroethene
Methylene chloride
Trichloroethene

Figures 7-1 through 7-4 show the occurrence of volatile organic chemicals of concern in pond surface water. The volatile organic chemicals of concern were reported in trace concentrations (0.008J to 0.036B mg/L) in some samples collected in the B series ponds. Methylene chloride was also reported in one sample collected in pond A-2. Most results for chloroform, trichloroethene, and 1,2-dichloroethene were J-qualified, indicating estimated quantities below the sample quantitation limit, and most results for acetone and methylene chloride were B-qualified, indicating presence of the compound in the laboratory blank (the data validation process did not result in qualifying these results as non-detect). The very low reported concentrations and the occurrence of acetone and methylene chloride in the laboratory method blanks suggest that some or all of these compounds may not be environmental contaminants in surface water but rather sampling or laboratory artifacts or naturally occurring (chloroform). Acetone and methylene chloride are common laboratory contaminants, and it is not uncommon to detect halogenated methanes such as chloroform in surface waters. These same constituents were reported in trace concentrations in stream water during base flow and storm events. The fact that the maximum concentration of acetone (0.14 B mg/L) was detected in the terminal pond at Walnut and Indiana, following surface water treatment by activated carbon at the A-4 pond, further suggests that at least this compound is a sampling or laboratory artifact because acetone would be removed by treatment at pond A-4.

On the other hand, these constituents were reported in groundwater samples from OU6, and they cannot be conclusively excluded as environmental contaminants based on the available evidence. Therefore, they are retained as chemicals of concern in surface water.

7.5 RISK-BASED EVALUATION OF INFREQUENTLY DETECTED COMPOUNDS

Tetrachloroethene and 1,2-dichloroethane (detected at <5 percent frequency) were detected in pond surface water and compared to values equivalent to 1000 times chemical-specific RBCs (DOE 1994b). Although these chemicals were detected in pond surface water, the RBCs used in this screening evaluation were calculated assuming residential exposure to

groundwater This approach is extremely conservative, since it assumes daily ingestion of pond surface water as drinking water The RBCs are used to identify special-case chemicals of concern, that is, infrequently detected compounds that could pose a health risk if long-term exposure were to occur to maximum concentrations in a highly localized area The screen is discussed in Appendix B and the results for pond surface water are presented in Table B-5

Neither of the chemicals detected at low frequency in pond surface water exceeded 1000 times the RBC Therefore, no special-case chemicals of concern were identified in pond surface water

TABLE 7-1
ROCKY FLATS OU6
ORGANIC COMPOUNDS AND TOTAL METALS DETECTED AT
5% OR GREATER FREQUENCY
POND SURFACE WATER

Chemical	Maximum Detected Concentration (mg/L)	Detection Frequency %	Inorganic PCOC ? ⁽¹⁾
Organic Compounds			
1,2-Dichloroethene	0 003	8	
Acetone	0 14	25	
Chloroform	0 002	20	
Di-n-butylphthalate	0 002	12	
Methylene chloride	0 034	8	
Trichloroethene	0 006	12	
Metals			
Aluminum	1 02	98	No
Antimony	0 0205	6	No
Arsenic	0 0066	41	No
Barium	0 12	100	No
Cadmium	0 0022	22	No
Cesium	0 06	12	No
Chromium	0 0043	16	No
Cobalt	0 0036	35	No
Copper	0 0047	19	No
Lead	0 0158	78	No
Lithium	0 0545	100	No
Manganese	0 293	100	No
Mercury	0 00096	33	No
Molybdenum	0 0176	75	No
Nickel	0 0063	47	No
Selenium	0 0083	22	No
Silver	0 0027	6	No
Strontium	0 568	100	No
Tin	0 0119	20	No
Vanadium	0 0056	49	No
Zinc	0 0748	76	No

⁽¹⁾ Based on background comparison in Appendix A

TABLE 7-2
ROCKY FLATS OU6
ORGANIC COMPOUNDS AND TOTAL METALS DETECTED AT
LESS THAN 5% FREQUENCY
POND SURFACE WATER

Chemical	Maximum Detected Concentration (mg/L)	Detection Frequency %	Inorganic PCOC ? ⁽¹⁾
Organic Compounds			
1,2-Dichloroethane	0 001	2	
Tetrachloroethene	0 012	4	
Metals			
Beryllium	0 00034	4	No

⁽¹⁾ Based on background comparison in Appendix A

TABLE 7-3
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
POND SURFACE WATER
NONCARCINOGENS

Chemical	Maximum Detected Conc (mg/L)	Inhalation RfD	Oral RfD	Risk Factor	Risk Index	% of Total Risk Factor
Acetone	0.14	n/a	1.0E-01	1.4E+00	5.6E-01	55.6
Methylene chloride	0.034	9.0E-01	6.0E-02	5.7E-01	2.2E-01	22.5
1,2-Dichloroethene	0.003	n/a	9.0E-03	3.3E-01	1.3E-01	13.2
Chloroform	0.002	n/a	1.0E-02	2.0E-01	7.9E-02	7.9
Di-n-butylphthalate	0.002	n/a	1.0E-01	2.0E-02	7.9E-03	0.8
Total Risk Factor				2.5E+00		

RfDs are in units of mg/kg-day
n/a = not available

TABLE 7-4
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
POND SURFACE WATER
CARCINOGENS

Chemical	Maximum	Inhalation Slope Factor	*	Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
	Detected Conc (mg/L)						
Methylene chloride	0.034	1.6E-03	*	7.5E-03	2.6E-04	7.7E-01	76.5
Trichloroethene	0.006	6.0E-03	*	1.1E-02	6.6E-05	2.0E-01	19.8
Chloroform	0.002	8.0E-02	*	6.1E-03	1.2E-05	3.7E-02	3.7
Total Risk Factor					3.3E-04		

Slope factors are in units of 1/(mg/kg-day)

n/a = not available

* Inhalation of volatile organic compounds released to air in the outdoors is a negligible pathway

Therefore, oral toxicity factors were used in the screen

TABLE 7-5
ROCKY FLATS OU6
CHEMICALS OF CONCERN
POND SURFACE WATER

1,2-Dichloroethene
Acetone
Chloroform
Methylene chloride
Trichloroethene

8 0 STREAM SEDIMENT CHEMICALS OF CONCERN

8 1 STREAM SEDIMENT DATA SET

Fifteen stream sediment samples were collected in the North and South Walnut Creeks including locations upgradient of the A and B series ponds to help characterize potential contaminant transport through surface water/sediment pathways. Samples were analyzed for metals, radionuclides, volatile and semivolatile organic compounds, and pesticides/PCBs. The sampling and analytical program for stream sediments is summarized in Tables 2-1 and 2-2.

8 2 BACKGROUND COMPARISON AND FREQUENCY OF DETECTION

Table 8-1 summarizes the maximum detected concentrations and detection frequencies for organic compounds and metals, and the results of the background comparison for metals and radionuclides detected in the stream sediment samples. All analytes were detected at greater than 5 percent frequency. Background data from streambeds reported in the Background Geochemical Characterization Report (DOE 1993) were used for comparison. The statistical comparisons of metals and radionuclide results to background data are presented in detail in Appendix A.

Radionuclides are assumed to be detected at 100 percent frequency (that is, both negative and positive results were used in the data set). Radionuclides above background levels are listed in the concentration/toxicity screen in Table 8-4.

Organic compounds and inorganic analytes above background levels were included in concentration/toxicity screens to select OU-wide chemicals of concern, with the exception of arsenic, manganese, and barium. These metals are considered to be naturally occurring, for the reasons explained in Section 8.3.

8 3 ELIMINATION OF ARSENIC, MANGANESE, AND BARIUM AS CHEMICALS OF CONCERN IN STREAM SEDIMENT

8 3 1 Arsenic

The statistical background evaluation of arsenic in stream sediments indicated that, because of failure of the Gehan test, arsenic in stream sediments was statistically different from background and should be retained as a potential chemical of concern. However, a more in-depth review of the data supports the conclusion that arsenic in stream sediments is naturally occurring and is not an environmental contaminant.

Summary statistics for arsenic in surface soil and stream sediment are shown in the table below. Arsenic in surface soil did not exceed background levels (see Appendix A). The reasons for concluding arsenic is not a contaminant in stream sediment follow:

	Arsenic in Surface Soil, mg/kg		Arsenic in Stream Sediment, mg/kg	
	Background	OU6	Background	OU6
Mean	5.8	5.3	2.4	3.6
Std Dev	1.8	1.9	2.5	1.3
Maximum	8.5	11.0	17.3	5.8
N	18	119	59	15
Det Freq	100%	100%	49%	93%

- The OU6 stream sediment maximum (5.8 mg/kg) is approximately three times lower than the background maximum (17.3 mg/kg). The two highest detected values (7.3 and 17.3 mg/kg) were in the background samples.
- The OU6 stream sediment maximum of 5.8 mg/kg is well below the UTL₉₉₉₉ of background (10 mg/kg) and below the background mean plus two standard deviations (7.4 mg/kg).

- Surface soil is the largest source of sediment in stream beds. Arsenic in OU6 surface soil did not differ significantly from background. Since the maximum arsenic concentration in stream sediments is equivalent to the mean background concentration in surface soil, arsenic is not considered a contaminant in stream sediments in OU6.

8.3.2 Manganese

The statistical background evaluation of manganese in stream sediments indicated that, because of failure of the Gehan test, manganese in stream sediments was statistically different from background levels and should be retained as a potential chemical of concern. However, a more in-depth review of the data supports the conclusion that manganese in stream sediments is naturally occurring and is not an environmental contaminant.

Summary statistics for manganese in surface soil and stream sediment are shown in the table below. Manganese in surface soil did not exceed background levels (see Appendix A). The reasons for concluding manganese is not a contaminant in stream sediment follow:

	Manganese in Surface Soil mg/kg		Manganese in Stream Sediment, mg/kg	
	Background	OU6	Background	OU6
Mean	443	265	217	366
Std Dev	457	114	225	240
Maximum	2220	823	1280	1000
N	18	119	59	15
Det Freq	100%	100%	80%	100%

- The OU6 stream sediment maximum (1000 mg/kg) is lower than the background maximum (1280 mg/kg). The next highest OU6 stream sediment concentration was 639 mg/kg, which is below the maximum values detected in background and OU6 surface soils.

- Surface soil is the largest source of sediment in stream beds. Manganese in OU6 surface soils did not exceed background levels. The mean manganese concentration in stream sediments (366 mg/kg) is below the mean background concentration in surface soil (443 mg/kg). Therefore, manganese is not considered a contaminant in stream sediments in OU6 but is considered to be the result of naturally occurring manganese in native geologic materials.

8.3.3 Barium

The statistical background evaluation of barium in stream sediments indicated that, because of failure of the Gehan test, barium in OU6 stream sediments was statistically different from background and should be retained as a potential chemical of concern. However, a more in-depth review of the data supports the conclusion that barium in stream sediments is naturally occurring and is not an environmental contaminant.

Summary statistics for barium in surface soil and stream sediment are shown in the table below. Barium did not exceed background levels in surface soil. The reasons for concluding barium is not a contaminant in stream sediment follow:

	Barium in Surface Soil, mg/kg		Barium in Stream Sediment, mg/kg	
	Background	OU6	Background	OU6
Mean	194	147	78	107
Std Dev	84	52	56	32
Maximum	470	272	244	177
N	18	119	57	15
Det. Freq	100%	100%	100%	100%

- The OU6 sediment maximum (177 mg/kg) is lower than the background maximum (244 mg/kg).

- The OU6 sediment maximum of 177 mg/kg is below the background UTL_{99/99} of 251 mg/kg and below the background mean plus two standard deviations (190 mg/kg)
- Surface soil is the largest source of sediment in stream beds. Barium in OU6 surface soils was not statistically different from background. Since the maximum barium concentration in stream sediments is comparable to the mean concentrations in surface soil, and barium in surface soil does not exceed background levels, barium is not considered a contaminant in stream sediments in OU6.

Other metals included in the concentration/toxicity screens may also be naturally occurring but were not evaluated in detail.

8.4 CONCENTRATION/TOXICITY SCREENS

Concentration/toxicity screens for chemicals of concern in stream sediments are presented in Tables 8-2 through 8-4. All analytes that contribute at least 1 percent of the total risk factor are retained as OU-wide chemicals of concern for quantitative risk assessment. The metal chemicals of concern in sediment were also identified as being above background levels in surface soil. Chemicals of concern are listed below and in Table 8-5.

OU-Wide Chemicals of Concern
Stream Sediments

Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(a)anthracene
Indeno(123-cd)pyrene
Chrysene
Cobalt
Strontium
Vanadium
Zinc
Plutonium-239,240
Americium-241

The occurrence of organic chemicals of concern in stream sediments is shown in Figure 8-1. Inorganic chemicals of concern have not been displayed because no results exceeded the background mean plus two standard deviations, which is the criterion for data display in the Phase I RFI/RI report.

Chemicals of potential concern detected in stream sediments that do not have EPA-established toxicity factor are benzo(ghi)perylene, dibenzofuran, and phenanthrene. Because of the lack of toxicity factors, these compounds cannot be evaluated in a toxicity- or risk-based screen to select chemicals of concern. However, their potential contribution to overall risk will be evaluated qualitatively in the risk assessment for OU6.

8.5 RISK-BASED EVALUATION OF INFREQUENTLY DETECTED COMPOUNDS

There were no compounds detected in stream sediments at less than 5 percent frequency, so the RBC screening evaluation for infrequently detected compounds was not performed.

TABLE 8-1
ROCKY FLATS OU6
ORGANIC COMPOUNDS AND METALS DETECTED AT
5% OR GREATER FREQUENCY⁽¹⁾
STREAM SEDIMENT

Chemical	Maximum Detected Concentration (mg/kg)	Detection Frequency %	Inorganic PCOC ? ⁽²⁾
Organic Compounds			
Acenaphthene	0.13	7	
Acetone	0.063	7	
Anthracene	0.15	20	
Benzo(a)anthracene	0.43	27	
Benzo(a)pyrene	0.48	33	
Benzo(b)fluoranthene	0.65	27	
Benzo(g,h,i)perylene	0.16	13	
Benzo(k)fluoranthene	0.23	20	
Benzoic acid	0.51	33	
Benzyl alcohol	0.041	7	
Bis(2-ethylhexyl)phthalate	0.19	27	
Butyl benzylphthalate	0.12	7	
Chrysene	0.51	33	
Di-n-butyl phthalate	0.075	33	
Dibenzofuran	0.037	7	
Fluoranthene	1	47	
Fluorene	0.089	7	
Indeno(1,2,3-cd)pyrene	0.18	20	
Methylene chloride	0.007	7	
Naphthalene	0.046	7	
Phenanthrene	0.75	33	
Pyrene	0.96	33	
Metals			
Aluminum	11600	100	No
Antimony	26.3	13	No
Arsenic	5.8	93	Yes
Barium	177	100	Yes
Beryllium	1	53	No
Cadmium	0.8	7	No
Cesium	18.1	47	No
Chromium	12.3	100	No
Cobalt	12.4	100	Yes
Copper	17.7	60	No
Lead	94.8	100	No
Lithium	15.2	93	No

TABLE 8-1
(Concluded)

Chemical	Maximum Detected Concentration (mg/kg)	Detection Frequency %	> Background?
Manganese	1000	100	Yes
Mercury	0.13	27	No
Nickel	19.2	47	No
Selenium	0.45	13	No
Silver	1.4	7	No
Strontium	95.8	100	Yes
Thallium	0.46	33	No
Vanadium	33.9	100	Yes
Zinc	178	100	Yes

⁽¹⁾ All detected analytes were detected at a frequency greater than 5 percent

⁽²⁾ Based on background comparison (Appendix A)

TABLE 8-2
ROCKY FLATS PLANT OU6
CONCENTRATION/TOXICITY SCREEN
STREAM SEDIMENT
NONCARCINOGENS

Chemical	Maximum		Inhalation RfD	Oral RfD	Risk Factor	Risk Index	% of Total Risk Factor
	Detected Conc (mg/kg)						
Vanadium	33.9	n/a	7.0E-03	4.8E+03	8.2E-01	82.4	
Zinc	178	n/a	3.0E-01	5.9E+02	1.0E-01	10.1	
Cobalt	12.4	n/a	6.0E-02	2.1E+02	3.5E-02	3.5	
Strontium	95.8	n/a	6.0E-01	1.6E+02	2.7E-02	2.7	
Pyrene	0.96	n/a	3.0E-02	3.2E+01	5.4E-03	0.5	
Fluoranthene	1	n/a	4.0E-02	2.5E+01	4.3E-03	0.4	
Bis(2-ethylhexyl)phthalate	0.19	n/a	2.0E-02	9.5E+00	1.6E-03	0.2	
Fluorene	0.089	n/a	4.0E-02	2.2E+00	3.8E-04	0.0	
Acenaphthene	0.13	n/a	6.0E-02	2.2E+00	3.7E-04	0.0	
Naphthalene	0.046	n/a	4.0E-02	1.2E+00	2.0E-04	0.0	
Di-n-butylphthalate	0.075	n/a	1.0E-01	7.5E-01	1.3E-04	0.0	
Acetone	0.063	n/a	1.0E-01	6.3E-01	1.1E-04	0.0	
Butyl benzylphthalate	0.12	n/a	2.0E-01	6.0E-01	1.0E-04	0.0	
Anthracene	0.15	n/a	3.0E-01	5.0E-01	8.5E-05	0.0	
Benzyl alcohol	0.041	n/a	3.0E-01	1.4E-01	2.3E-05	0.0	
Benzoic acid	0.51	n/a	4.0E+00	1.3E-01	2.2E-05	0.0	
Methylene chloride	0.007	9.0E-01	6.0E-02	1.2E-01	2.0E-05	0.0	
Total Risk Factor				5.9E+03			

RfDs are in units of mg/kg-day

n/a = not available

**TABLE 8-3
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
STREAM SEDIMENT
CARCINOGENS**

Chemical	Maximum	Inhalation Slope Factor	Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
	Detected Conc (mg/kg)					
Benzo(a)pyrene	0.48	n/a	7.3E+00	3.5E+00	7.8E-01	78.2
Benzo(b)fluoranthene	0.65	n/a	7.3E-01	4.7E-01	1.1E-01	10.6
Benzo(a)anthracene	0.43	n/a	7.3E-01	3.1E-01	7.0E-02	7.0
Indeno(1,2,3-cd)pyrene	0.18	n/a	7.3E-01	1.3E-01	2.9E-02	2.9
Chrysene	0.51	n/a	7.3E-02	3.7E-02	8.3E-03	0.8
Benzo(k)fluoranthene	0.23	n/a	7.3E-02	1.7E-02	3.7E-03	0.4
Bis(2-ethylhexyl)phthalate	0.19	n/a	1.4E-02	2.7E-03	5.9E-04	0.1
Methylene chloride	0.007	1.6E-03	7.5E-03	5.3E-05	1.2E-05	0.0
Total Risk Factor				4.5E+00		

Slope factors are in units of 1/(mg/kg-day)

n/a = not available

TABLE 8-4
ROCKY FLATS OU6
CONCENTRATION/TOXICITY SCREEN
STREAM SEDIMENT
RADIONUCLIDES

Chemical	Maximum Activity (pCi/g)	Inhalation Slope Factor	Oral Slope Factor	Risk Factor	Risk Index	% of Total Risk Factor
Plutonium-239,240	1.95	3.8E-08	2.3E-10	7.4E-08	7.6E-01	75.5
Americium-241	0.75	3.2E-08	2.4E-10	2.4E-08	2.4E-01	24.5
Total Risk Factor				9.8E-08		

Slope factors are in units of 1/pCi

TABLE 8-5
ROCKY FLATS OU6
CHEMICALS OF CONCERN
STREAM SEDIMENTS

Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Indeno(1,2,3-cd)pyrene
Cobalt
Strontium
Vanadium
Zinc
Americium-241
Plutonium-239,240

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APPENDIX A
BACKGROUND COMPARISON FOR METALS AND RADIONUCLIDES

APPENDIX A

BACKGROUND COMPARISON FOR METALS AND RADIONUCLIDES

Concentrations of metals and radionuclides measured in soil, groundwater, surface water, and sediment in OU6 were compared to background concentrations in order to identify OU6 analytes whose concentrations are statistically higher than background levels. These analytes are then identified as potential chemicals of concern for further evaluation. The background data used for comparison were reported in the Background Geochemical Characterization Report (DOE 1993), except for the surface soil data, which were not available in the 1993 report. The background surface soil data were collected in the Rock Creek area during the 1991 OU1 Phase III investigation and the 1993 OU2 Phase II investigation. Analytical results from each medium sampled were pooled, and the background comparison was performed on an OU-wide basis.

The procedures applied in the background comparisons are shown in the flow chart in Figure A-1. Three major steps were involved: (1) data aggregation, (2) statistical background comparisons, and (3) professional judgement of statistical results. Each of these steps is discussed below.

A.1 DATA AGGREGATION

The chemical data were grouped by medium into seven categories:

- Subsurface soil in the upper hydrostratigraphic unit (UHSU)
- Surface soil
- Pond sediment
- Stream sediment
- Groundwater (UHSU)
- Pond surface water
- Baseflow stream surface water

In general, each medium has 29 analytes for metals and 13 analytes for radionuclides, as unfiltered or filtered concentrations. Soil media (surface soil, subsurface soil, pond

sediment, and stream sediment) were each analyzed for metals and radionuclides, totaling eight media-analyte groups. Liquid media (groundwater and pond surface water) were each analyzed for filtered and unfiltered metals and filtered and unfiltered radionuclides. Therefore, there are a total of 16 media-analyte groups to be evaluated in the background comparisons, as shown in Table A-1.

Most of OU6 media-analyte groups were compared directly to the corresponding background groups. Exceptions were pond sediment and pond surface water due to the lack of background pond data. Background data from seep/spring sampling locations (rather than from background stream locations) were adopted for comparison to OU6 pond data because of the similarity of the flow conditions for ponds and seeps/springs (both have relatively long residence time).

A.2 STATISTICAL BACKGROUND COMPARISON

Background comparisons were performed according to the procedures given in the "Guidance Document, Statistical Comparisons of Site-To-Background Data in Support of RFI/RI Investigations" (EG&G 1994), which was primarily based on the methodology proposed by Gilbert (Gilbert 1993). The formal statistical tests were the Gehan test, Slippage test, Quantile test, and t-test. Analytical results were also compared to the upper tolerance limit ($UTL_{99/99}$) of background to identify high concentrations outside of background range. The conditions for applying each of the tests are briefly discussed below.

A.2.1 Formal Statistical Tests

Four formal statistical tests were performed to test the difference between the background and site populations. If any of the four statistical tests was significant, the analyte was considered to be a potential chemical of concern. Significance was defined as a p value less than or equal to 0.05, the Type I (false positive) error rate. Non-detects of metals were treated as described below for each test. All the radionuclide results were treated as detects.

1 Gehan Test

The Gehan test (Gehan 1965, explained in Gilbert 1993) is a non-parametric ranking test. It was performed for all the media-analyte groups. For non-detects, the reporting limits were used for ranking purposes.

2 Slippage Test

The slippage test (Rosenbaum 1954), a non-parametric test, was performed by comparing the OU6 measurements to the maximum background measurement (detect or non-detect). The p-value for the probability of the number of site measurements greater than the maximum background measurement was calculated. Reporting limits were used for non-detects.

3 Quantile Test

The Quantile test (Gilbert and Simpson 1992), a non-parametric test, was performed by first ranking the combined background and OU6 measurements from largest to smallest. If there were no non-detects among the top 20% of the combined background and OU6 measurements, the probability of the number of site measurements within the top 20% of the data set was calculated. If there were any non-detects among the top 20% of the measurements, no Quantile test was performed.

4 t-Test

The t-test, a parametric statistical test, was performed under these conditions that (1) the non-detects in each of the data sets represent less than 20% of the measurements, and (2) EITHER each of the data sets contains at least 20 data points, OR both of the data sets are normally distributed.

For simplicity, the t-test was only performed when condition (1) and the first option of condition (2) were met. Non-detect results for metals were replaced by one-half the reporting limits.

The homogeneity of the variance was tested following Levene's test (EPA 1992) If the variances from both data sets were the same, the standard t-test was performed If the variances were not the same, the unequal variance t-test (Helsel and Hirsch 1992) was performed

A.2.2 Upper Tolerance Limit (UTL_{99/99}) Comparison

For each media-analyte in the background data, an upper tolerance limit with 99% confidence and 99% coverage (UTL_{99/99}) was calculated, assuming the background data were normally distributed (EG&G 1994) In calculating the UTL, if non-detects were less than 80% of the data, one-half the reporting limit was used as the result for non-detect samples Otherwise, the maximum background measurement, instead of the UTL_{99/99}, was used in the comparisons For the radionuclides, all the results were treated as detects (EG&G 1994)

Each of the OU6 measurements was compared to the UTL_{99/99} If one or more OU6 measurements exceed the background UTL_{99/99}, the analyte was considered as a potential chemical of concern for further evaluation, even if the analyte did not exceed background levels according to the formal statistical evaluation

A.3 BACKGROUND COMPARISON RESULTS

The number of inorganic potential chemicals of concern in each media-analyte group resulting from the background comparisons is summarized in Table A-1 Out of 374 media-analytes, 142 media-analytes were identified as above background based on the formal statistical tests An additional 32 media-analytes were identified as above background based on the UTL_{99/99} comparison alone

The summary tables for the background comparisons for each media-analyte group are presented in the remaining tables in Appendix A

A.4 PROFESSIONAL JUDGEMENT FOR STATISTICAL RESULTS

Statistical professional judgement was applied for those media-analytes that were below background according to the formal statistical tests but failed the UTL_{99/99} comparisons. The professional judgement consisted of performing a log-normal UTL_{99/99} comparison if the background data were log-normally distributed.

According to the background comparison methodology (EG&G 1994), the UTL_{99/99} was calculated assuming a normal distribution of background data. However, log-normal distribution may better describe some geochemical data, as indicated in the Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities (EPA 1992). Log-normal-based UTL_{99/99}s were calculated for media-analytes that passed the formal statistical tests but failed to pass the normal-based UTL_{99/99} comparison. If a media-analyte passed the log-normal-based UTL_{99/99} comparison, probability plots were generated for both normal and log-normal distributions. If the probability plots indicated that the data better fit a log-normal distribution, the media-analyte was eliminated from the potential chemical of concern list.

The results of the log-normal-based UTL_{99/99} comparisons are presented in the remark column in the summary tables. Based on the results of the log-normal UTL_{99/99} comparison, the following ten analytes were eliminated as potential chemicals of concern:

Medium	Analyte
Surface Soil	Aluminum Cadmium Uranium-233,234
Subsurface Soil	Copper
Groundwater	Total (unfiltered) Tin Filtered Radium-228
Pond Sediment	Beryllium Cadmium Nickel Tritium

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TABLE A-1
ROCKY FLATS OU6
Background Comparison Summary

Media	Background Data	OU6 Data	Analyte Group	No of Analytes in Comparison	No of Analytes Significant in Tests	No of Analytes Greater than UTL ^{99/99}	No of PCOC
Surface Soil	Rock Creek Surface Soil	Surface Soil & Dry Sediment	Metals Rads	28 7	9 2	15 5	16 4
Subsurface Soil	UHSU Subsurface Soil	Subsurface Soil	Metals Rads	28 8	3 5	8 6	7 6
Groundwater	UHSU* Groundwater	Historic and New Wells	Unfiltered Metals Filtered Metals	29 28	25 13	26 17	25 17
	UHSU Groundwater	Historic and New Wells	Unfiltered Rads Filtered Rads	11 11	4 7	5 6	5*** 8***
Pond Sediment	Seep/Spring Sediment	Pond Sediment	Metals Rads	27 12	11 10	7 8	12 10
	Seep/Spring* Surface Water	Pond Surface Water	Unfiltered Metals Filtered Metals	29 28	3 4	1 4	3 4
Stream Sediment	Seep/Spring Surface Water	Pond Surface Water	Unfiltered Rads Filtered Rads	10 7	4 2	2 2	4 3***
	Stream Sediment	Stream Sediment	Metals Rads	26 12	11 3	2 1	11 3***

* In these background data files non detect records with extremely high reporting limits were not used

** Background data files are from 1993 Background Geochemical Characterization Report except for surface soil (DOE 1993)

*** Some sample sizes too small to draw conclusion

TABLE A-2
ROCKY FLATS OU6
Background Comparison Summary of
Surface Soil Metals
(Concentration Unit MG/KG)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	I	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
ALUMINIUM	18	119			1.00	1.00	1.00	0.2320	0.7081		0.9976	1.0000	N	21915	4	3	NO	Not a PCOC by PJ (1)				
ANTIMONY	18	103			0.00	0.00	0.54	1.0000	0.0174		0.0174		Y	50	0	0	YES					
ARSENIC	18	119			1.00	1.00	1.00	0.4222	0.8522		0.8614	0.7828	N	12	9	0	NO					
BARIUM	18	119			1.00	1.00	1.00	1.0000	0.9975		0.9914	0.9912	N	528	0	0	NO					
BERYLLIUM	18	119			0.50	0.50	0.87	1.0000			0.4654		N	5	2	0	NO					
CADMIUM	17	119			0.35	0.35	0.47	0.8750			0.3602		N	5	0	1	NO	Not a PCOC by PJ (1)				
CALCIUM	18	119			1.00	1.00	1.00	0.0001	0.0119		0.0001	0.0001	Y	13573	3	24	YES					
CESIUM	18	114			0.50	0.50	0.91	1.0000			0.2843		N	630	8	0	NO					
CHROMIUM	18	119			1.00	1.00	0.99	0.6532	0.9848		0.9998	1.0000	N	24	8	1	YES					
COBALT	18	119			1.00	1.00	1.00	1.0000	0.1921		0.0028	0.0057	Y	24	8	0	YES					
COPPER	18	119			1.00	1.00	1.00	0.0099	0.0119		0.0007	0.0001	Y	27	3	7	YES					
IRON	18	119			1.00	1.00	1.00	0.6532	0.4417		0.9190	0.8919	N	28160	4	3	YES					
LEAD	18	119			1.00	1.00	1.00	0.0909	0.4743		0.9995	1.0000	N	61	4	4	YES					
LITHIUM	18	119			1.00	1.00	0.97	0.1707			0.9889	0.9997	N	20	0	0	NO					
MAGNESIUM	18	119			1.00	1.00	1.00	0.4222	0.7081		0.3266	0.2969	N	7011	5	3	YES					
MANGANESE	18	119			1.00	1.00	1.00	1.0000	0.9557		0.9998	0.9999	N	2253	5	0	NO					
MERCURY	18	119			0.00	0.00	0.41	0.8686			0.0303		Y	0	2	1	YES					
MOLYBDENUM	18	119			0.06	0.06	0.01	1.0000			0.0185		Y	40	0	0	YES					
NICKEL	18	118			1.00	1.00	0.95	0.1228	0.4348		0.0308	0.1363	Y	26	9	0	YES					
POTASSIUM	18	119			1.00	1.00	0.92	0.8686	1.0000		1.0000	1.0000	N	5256	8	0	NO					
SELENIUM	18	119			0.72	0.72	0.27	1.0000			0.2903		N	1	4	0	NO					
SILICON	0	0			0.00	0.00	0.00											NO site measurement				
SILVER	18	119			0.00	0.00	0.09	0.8686			0.2388		N	10	0	1	YES					
SODIUM	18	119			0.50	0.50	1.00	0.6532			0.0547		N	1108	0	3	YES					
STRONTIUM	18	119			1.00	1.00	1.00	0.2320	0.0769		0.0714	0.0397	Y	90	1	6	YES					
THALLIUM	18	118			0.28	0.28	0.42	1.0000			0.6887		N	2	0	0	NO					
TIN	18	119			0.50	0.50	0.03	1.0000			1.0000		N	75	9	0	NO					
VANADIUM	18	119			1.00	1.00	1.00	0.2700	0.2375		0.4443	0.5916	N	55	6	4	YES					
ZINC	18	119			1.00	1.00	1.00	0.0099	0.0119		0.1244	0.0028	Y	86	6	11	YES					

(1) Professional judgment based on log normal UTL comparison

TABLE A-3
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
Surface Soil Metals
(Shippage Test, Quantile Test, Gehan Test, UTL Comparison)
(Concentration Unit MG/KG)

ANALYTE	N	B	N	S	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UTL	99	NGUTL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL
ALUMINUM	18	119			0	0	1.00	1.00	0.00	0.54	12886.1	10843.3	2279.9	4325.1	21915.4	3	17950.0	24100.0	10	0.2320	28	24	0.7081	2.826	1.645	0.9976														
ANTIMONY	18	103			18	47	0.00	0.54	15.5	13.6	9.8	8.5	50.0			0	50.0	43.6	0	1.0000	999	999	999.0000	2.111	1.645	0.0174														
ARSENIC	18	119			0	0	1.00	1.00	5.8	5.3	1.8	1.9	12.9	0		0	8.5	11.0	6	0.4222	29	24	0.8522	1.087	1.645	0.8614														
BARIUM	18	119			0	0	1.00	1.00	194.3	147.4	84.3	51.5	528.0	0		0	470.0	272.0	0	1.0000	28	20	0.9975	2.383	1.645	0.9914														
BERYLLIUM	18	119			9	15	0.50	0.87	1.6	0.8	0.9	0.3	5.2			0	5.0	1.5	0	1.0000	999	999	999.0000	0.087	1.645	0.4654														
CADMIUM	17	119			11	63	0.35	0.47	1.4	0.9	0.9	0.7	5.0			1	5.0	6.4	1	0.8750	999	999	999.0000	0.358	1.645	0.3602														
CALCIUM	18	119			0	0	1.00	1.00	5022.2	11383.1	2159.2	9689.8	13573.3	24	8810.0	59800.0	59	0.0001	28	28	0.0119	4.078	1.645	0.0001																
CESIUM	18	114			9	10	0.50	0.91	126.2	11.6	127.4	27.7	630.8	0		0	500.0	33.4	0	1.0000	999	999	999.0000	0.570	1.645	0.2843														
CHROMIUM	18	119			0	1	1.00	0.99	15.0	11.8	2.5	4.6	24.8	1		1	20.2	35.1	3	0.6532	29	22	0.9848	3.562	1.645	0.9998														
COBALT	18	119			0	0	1.00	1.00	7.8	8.7	4.3	2.7	24.8	0		0	24.0	20.3	0	1.0000	30	28	0.1921	2.775	1.645	0.0028														
COPPER	18	119			0	0	1.00	1.00	13.0	17.9	3.6	8.0	27.3	7		7	18.5	61.6	29	0.0099	28	28	0.0119	3.189	1.645	0.0007														
IRON	18	119			0	0	1.00	1.00	15381.7	14451.3	3226.6	4460.8	28160.4	3	24900.0	34600.0	3	0.6532	29	26	0.4417	1.399	1.645	0.9190																
LEAD	18	119			0	0	1.00	1.00	37.5	29.2	6.0	15.4	61.4	4		4	51.0	68.7	16	0.0909	28	25	0.4743	3.269	1.645	0.9995														
LITHIUM	18	119			0	4	1.00	0.97	11.0	9.2	2.3	3.4	20.0	0		0	15.0	18.1	12	0.1707	999	999	999.0000	2.288	1.645	0.9889														
MAGNESIUM	18	119			0	0	1.00	1.00	2853.3	3078.3	1049.9	1571.8	7011.5	3	5195.0	11400.0	6	0.4222	28	24	0.7081	0.449	1.645	0.3266																
MANGANESE	18	119			0	0	1.00	1.00	443.5	265.0	457.0	114.5	2253.5	0		0	2220.0	823.0	0	1.0000	28	22	0.9557	3.546	1.645	0.9998														
MERCURY	18	119			18	70	0.00	0.41	0.1	0.1	0.0	0.0	0.2	1		1	0.2	0.3	1	0.8686	999	999	999.0000	1.877	1.645	0.0303														
MOLYBDENUM	18	119			17	118	0.06	0.01	14.0	19.9	5.7	0.9	40.0	0		0	40.0	9.9	0	1.0000	999	999	999.0000	2.085	1.645	0.0185														
NICKEL	18	118			0	6	1.00	0.95	12.3	14.0	3.7	4.2	26.9	0		0	18.7	22.5	14	0.1228	29	26	0.4348	1.869	1.645	0.0308														
POTASSIUM	18	119			0	9	1.00	0.92	2977.9	2103.5	575.4	844.0	5256.8	0		0	4205.0	4430.0	1	0.8686	28	17	1.0000	4.155	1.645	1.0000														
SELENIUM	18	119			5	87	0.72	0.27	0.6	0.5	0.2	0.1	1.4			0	2.0	1.3	0	1.0000	999	999	999.0000	0.553	1.645	0.2903														
SILICON(1)																																								
SILVER	18	119			18	108	0.00	0.09	3.0	1.7	2.1	4.8	10.0	1		1	10.0	52.7	1	0.8686	999	999	999.0000	0.710	1.645	0.2388														
SODIUM	18	119			9	0	0.50	1.00	305.6	197.2	202.6	216.7	1108.0	3		3	1000.0	1650.0	3	0.6532	999	999	999.0000	1.601	1.645	0.0547														
STRONTIUM	18	119			0	0	1.00	1.00	35.3	45.8	13.8	29.9	90.1	6		6	79.1	255.0	10	0.2320	28	27	0.0769	1.465	1.645	0.0714														
THALLIUM	18	118			13	69	0.28	0.42	0.8	0.7	0.3	0.3	2.0	0		0	2.0	0.6	0	1.0000	999	999	999.0000	0.492	1.645	0.6887														
TIN	18	119			9	116	0.50	0.03	31.4	20.2	11.2	1.8	75.9	0		0	100.0	38.7	0	1.0000	999	999	999.0000	4.620	1.645	1.0000														
VANADIUM	18	119			0	0	1.00	1.00	31.6	32.5	6.0	10.7	55.6	4		4	45.6	75.9	9	0.2700	28	26	0.2375	0.140	1.645	0.4443														
ZINC	18	119			0	0	1.00	1.00	55.8	68.5	7.8	60.7	86.6	11		11	70.6	650.0	29	0.0099	28	28	0.0119	1.153	1.645	0.1244														

(1) No site measurement.

TABLE A-4
ROCKY FLATS OU6
Background Comparison Summary of
Surface Soil Radionuclides
(Concentration Unit pCi/G)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	1	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
AMERICIUM 241	15	105	100	100	100	100	100	100	0.0001	0.0001	0.0277	0.0001	0.0001	0.0001	0.0001	Y	Y	0.060	63	YES		
CESIUM 137	12	18	100	100	100	100	100	100	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	N	N	3.699	0	NO		
GROSS ALPHA	9	134	100	100	100	100	100	100	0.4760	0.9174	0.9174	0.9847	0.9847	0.9847	0.9847	N	N	42.220	3	YES		
GROSS BETA	18	134	100	100	100	100	100	100	0.3111	0.8711	0.8711	0.9778	0.9778	0.9778	0.9778	N	N	54.120	2	YES		
PLUTONIUM 239,240	18	118	100	100	100	100	100	100	0.0001	0.0001	0.0114	0.0001	0.0001	0.0001	0.0001	Y	Y	0.133	73	YES		
RADIUM 226	10	0	0.00	0.00	0.00	0.00	0.00	0.00													NO site measurement	
RADIUM 228	10	0	0.00	0.00	0.00	0.00	0.00	0.00													NO site measurement	
STRONTIUM 89 90	9	18	100	100	100	100	100	100	1.0000	1.0000	1.0000	0.9992	0.9992	0.9992	0.9992	N	N	2.217	0	NO		
TRITIUM (1)	0	27	0.00	0.00	0.00	0.00	0.00	0.00													NO BKGD measurement	
URANIUM,TOTAL	0	0	0.00	0.00	0.00	0.00	0.00	0.00													NO measurements	
URANIUM 233,234	13	125	100	100	100	100	100	100	0.2893	0.7453	0.7453	0.9844	0.9844	0.9844	0.9844	N	N	1.826	1	NO	Not a PCOC by PJ (2)	
URANIUM 235	13	125	100	100	100	100	100	100	0.4433	0.7453	0.7453	0.5160	0.5160	0.5160	0.5160	N	N	0.179	0	NO		
URANIUM 238	13	125	100	100	100	100	100	100	0.4922	0.9064	0.9064	0.9788	0.9788	0.9788	0.9788	N	N	2.086	0	NO		

(1) Concentration unit pCi/L

(2) Professional judgment based on log normal UTL comparison

TABLE A-5
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
Surface Soil Radionuclides
(Slippage Test, Quantile Test, Gehan Test, UTL Comparison)
(Concentration Unit pCi/G)

ANALYTE	N	B	N	S	ND	R	ND	S	DTE	R	DTE	S	MEAN	R	MEAN	S	STD	R	STD	S	UTL99	NGUTL	MAY	B	MAY	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL
AMERICIUM 241	15	105	0	0	0	100	100	100	0.019	0.376	0.010	0.601	0.060	63	0.040	3.243	72	0.0001	24	24	0.0277	4.575	1.645	0.0001																	
CESIUM 137	12	18	0	0	0	100	100	100	1.418	0.188	0.492	0.159	3.699	0	2.500	0.570	0	1.0000	6	0	1.0000	4.573	1.645	1.0000																	
GROSS ALPHA	9	134	0	0	0	100	100	100	20.833	20.027	3.969	19.453	42.220	3	28.000	186.000	11	0.4760	29	26	0.9174	2.161	1.645	0.9847																	
GROSS BETA	18	134	0	0	0	100	100	100	32.231	30.173	5.527	7.462	54.120	2	40.000	71.700	9	0.3111	31	26	0.8711	2.010	1.645	0.9778																	
PLUTONIUM 239 240	18	118	0	0	0	100	100	100	0.054	0.994	0.020	1.949	0.133	73	0.100	15.220	78	0.0001	28	28	0.0114	4.862	1.645	0.0001																	
RADIUM 226(1)	10	0	0	0	0																																				
RADIUM 228(1)	10	0	0	0	0																																				
STRONTIUM 89 90	9	18	0	0	0	100	100	100	0.619	0.194	0.297	0.122	2.217	0	1.000	0.500	0	1.0000	6	0	1.0000	3.143	1.645	0.9992																	
TRITIUM(2 3)	0	27	0	0	0																																				
URANIUM TOTAL(4)	0	0	0	0	0																																				
URANIUM 233 234	13	125	0	0	0	100	100	100	1.167	1.048	0.147	0.284	1.826	1	1.470	2.020	12	0.2893	28	25	0.7453	2.154	1.645	0.9844																	
URANIUM 235	13	125	0	0	0	100	100	100	0.047	0.046	0.030	0.030	0.179	0	0.100	0.160	8	0.4433	28	25	0.7453	0.040	1.645	0.5160																	
URANIUM 238	13	125	0	0	0	100	100	100	1.200	1.077	0.198	0.293	2.086	0	1.520	2.082	7	0.4922	28	24	0.9064	2.030	1.645	0.9788																	

- (1) No site measurement
(2) Concentration Unit pCi/L
(3) No detect record from site
(4) No background measurement

TABLE A-6
ROCKY FLATS OU6
Background Comparison Summary of
Subsurface Soil Metals
(Concentration Unit MG/KG)

ANALYTE	N B	N S	DTE-B	DTE-S	P SLIP	P QUAN	P GEHAN	P T 1	SIGNIFIC	UT199	NGUTL	PCOC	REMARK
ALUMINUM	98	231	1.00	1.00	1.0000	1.0000	1.0000	1.0000	N	450831	0	NO	
ANTIMONY	66	210	0.18	0.07	1.0000		0.1658		N	47.0	0	NO	
ARSENIC	99	231	0.81	0.99	1.0000	0.8480	0.3116	0.7957	N	17.0	0	NO	
BARIUM	99	231	0.92	1.00	0.1153	0.0006	0.0001	0.0004	Y	371.1	17	YES	
BERYLLIUM	99	231	0.91	0.84	1.0000	1.0000	1.0000	1.0000	N	18.2	0	NO	
CADMIUM	81	211	0.48	0.08	1.0000		1.0000		N	2.0	0	NO	
CALCIUM	99	231	0.90	1.00	0.0385	0.0001	0.0001	0.0001	Y	532481	52	YES	
CESIUM	95	221	0.78	0.68	1.0000		1.0000		N	1014.9	0	NO	
CHROMIUM	99	231	1.00	0.98	0.7000	1.0000	1.0000	0.9998	N	89.1	3	YES	
COBALT	99	231	0.34	0.95	1.0000		0.9996		N	38.1	0	NO	
COPPER	99	231	0.97	1.00	1.0000	0.9931	0.9998	0.9978	N	49.0	1	NO	Not a PCOC by PJ (1)
IRON	99	231	1.00	1.00	1.0000	0.9999	1.0000	0.9999	N	52385.2	0	NO	
LEAD	99	231	1.00	1.00	0.4894	0.9548	0.1262	0.2347	N	31.0	2	YES	
LITHIUM	99	209	0.48	0.87	1.0000		1.0000		N	41.9	0	NO	
MAGNESIUM	99	231	0.71	1.00	1.0000	0.8663	0.5539		N	12147.1	0	NO	
MANGANESE	99	231	1.00	1.00	1.0000	0.9998	0.9998	0.9813	N	1194.0	0	NO	
MERCURY	86	231	0.38	0.31	1.0000		1.0000		N	2.1	0	NO	
MOLYBDENUM	99	231	0.18	0.02	1.0000		0.9848		N	67.6	0	NO	
NICKEL	96	231	0.96	0.66	1.0000	1.0000	1.0000		N	79.9	0	NO	
POTASSIUM	98	230	0.40	0.60	1.0000		1.0000		N	8362.3	0	NO	
SELENIUM	82	211	0.27	0.09	1.0000		1.0000		N	7.1	0	NO	NO site measurement
SILICON													
SILVER	83	230	0.43	0.00	1.0000		1.0000		N	33.1	0	NO	
SODIUM	99	231	0.18	1.00	1.0000		0.9989		N	3680.0	0	NO	
STRONTIUM	99	231	0.43	1.00	0.7000		0.0003		Y	269.9	6	YES	
THALLIUM	75	223	0.05	0.29	1.0000		0.8231		N	20.0	0	NO	
TIN	92	231	0.23	0.03	1.0000		1.0000		N	383.7	0	NO	
VANADIUM	99	231	0.98	1.00	1.0000	0.9998	1.0000	0.9982	N	112.8	1	YES	
ZINC	98	231	1.00	1.00	0.7021	0.9259	0.8970	0.6826	N	182.9	4	YES	

(1) Professional judgment based on log normal UTL comparison

TABLE A-8
ROCKY FLATS OU6
Background Comparison t-Test Results of
Subsurface Soil Metals
(Concentration Unit MG/KG)

ANALYTE	N	B	N	S	ND	B	ND	S	MEAN B	MEAN S	STD B	STD S	F	CA	F	TAB	DF	T	CA	T	1	95	P	T	1	REMARK
ALUMINUM	98	231			0	0	0	0	127520	72493	113106	35214	257	38	105	-4720	166	10000								
ANTIMONY	66	210			54	195			70	67	54	27														NNDT more than 20%
ARSENIC	99	231			19	2			40	36	46	18	94	38	111	0829	166	07957								
BARIUM	99	231			8	0			970	1608	960	2465	67	38	326	3382	165	00004								
BERYLLIUM	99	231			9	37			48	07	47	03	1822	38	98	-8613	166	10000								
CADMIUM	81	211			42	195			09	05	04	02														NNDT more than 20%
CALCIUM	99	231			10	0			69958	367249	161989	45526	781	38	320	8716	165	00001								
CESIUM	95	221			21	71			2307	345	2734	449														NNDT more than 20%
CHROMIUM	99	231			0	4			196	108	243	186	26	38	328	-3570	165	09998								
COBALT	99	231			65	12			86	64	103	30														NNDT more than 20%
COPPER	99	231			3	0			127	97	127	59	36	38	328	-2874	165	09978								
IRON	99	231			0	0			145320	91714	132573	52120	59	38	111	-3896	166	09999								
LEAD	99	231			0	1			109	115	70	78	15	38	328	0724	165	02347								
LITHIUM	99	209			51	27			147	95	95	56														NNDT more than 20%
MAGNESIUM	99	231			29	0			27065	24504	33064	9705														NNDT more than 20%
MANGANESE	99	231			0	0			2176	1434	3420	1198	67	38	108	2107	166	09813								
MERCURY	86	231			53	159			03	01	06	01														NNDT more than 20%
MOLYBDENUM	99	231			81	227			183	198	76	19														NNDT more than 20%
NICKEL	96	231			4	79			209	105	206	67														NNDT more than 20%
POTASSIUM	98	230			59	93			16274	9138	23561	4732														NNDT more than 20%
SELENIUM	82	211			60	192			15	05	19	01														NNDT more than 20%
SILICON	0	0			0	0																				NO BKGD measurement
SILVER	83	230			47	229			58	10	94	01														NNDT more than 20%
SODIUM	99	231			81	0			8668	1580	4411	1293														NNDT more than 20%
STRONTIUM	99	231			56	1			692	813	703	748														NNDT more than 20%
THALLIUM	75	223			71	158			13	08	12	03														NNDT more than 20%
TIN	92	231			71	223			666	204	1102	34														NNDT more than 20%
VANADIUM	99	231			2	0			315	227	285	118	63	38	113	2979	166	09982								
ZINC	98	231			0	0			369	339	511	535	01	38	327	0475	165	06826								

NNDT = Number of non-detects

TABLE A-9
ROCKY FLATS OU6
Background Comparison Summary of
Subsurface Soil Radionuclides
(Concentration Unit pCi/G)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	1	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
AMERICIUM 241	28	208			1.00	1.00	1.00	0.0001	0.0009	0.0001	0.0228	Y		0.022		21	YES					
CESIUM 137	99	0																				NO site measurement
GROSS ALPHA	99	209			1.00	1.00	0.4597	1.0000	1.0000	1.0000	1.0000	N		51.423		2	YES					
GROSS BETA	99	223			1.00	1.00	1.0000	1.0000	1.0000	1.0000	1.0000	N		42.022		0	NO					
PLUTONIUM 239 240	99	206			1.00	1.00	0.0001	0.0001	0.0001	0.0001	0.0001	Y		0.025		43	YES					
RADIUM 226	83	0																				NO site measurement
RADIUM 228	83	0																				NO site measurement
STRONTIUM 89 90	99	0																				NO site measurement
TRITIUM (1)	99	12			1.00	1.00	1.0000	0.9479	0.9564			N		503.616		0	NO					
URANIUM TOTAL	0	0																				NO site measurement
URANIUM 233 234	99	230			1.00	1.00	1.0000	0.0256	0.0344	0.2701		Y		3.441		0	YES					
URANIUM 235	99	230			1.00	1.00	1.0000	0.4617	0.0001	0.0009		Y		0.153		1	YES					
URANIUM 238	99	230			1.00	1.00	0.6991	0.8497	0.3157	0.2637		N		1.807		2	YES					

(1) Concentration Unit pCi/L

TABLE A-11
ROCKY FLATS OU6
Background Comparison Summary of
UHSU Groundwater Unfiltered Metals
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	I	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
ALUMINUM	149	106			0.95	0.38	0.16	0.0090		0.0001	0.0001	0.0001	0.0001	0.0007	Y			25624.6	18	YES		
ANTIMONY	141	92			0.38	0.28	0.52	0.0147		0.0211					Y			55.8	7	YES		
ARSENIC	138	106			0.28	0.74	0.98	0.0001		0.0001					Y			8.8	6	YES		
BARIUM	149	107			0.74	0.12	0.30	0.0002		0.0001	0.0001				Y			300.4	32	YES		
BERYLLIUM	148	100			0.12	0.20	0.26	0.0049		0.0001					Y			5.0	9	YES		
CADMIUM	148	106			0.20	1.00	1.00	0.0001		0.0001					Y			11.1	6	YES		
CALCIUM	149	107			1.00	0.25	0.02	1.0000		0.0001	0.0001				Y			145353.0	32	YES		
CESIUM	142	97			0.25	0.48	0.75	1.0000		0.0001					N			934.7	0	NO		
CHROMIUM	145	107			0.48	0.16	0.45	0.0020		0.0001					Y			186.4	7	YES		
COBALT	148	107			0.16	0.74	0.54	0.0001		0.0001					Y			50.0	7	YES		
COPPER	148	107			0.74	0.98	0.95	0.0019		0.0001					Y			45.3	20	YES		
IRON	149	106			0.98	0.70	0.73	0.0002		0.0001	0.0001				Y			31518.5	18	YES		
LEAD	141	107			0.70	0.77	0.93	0.0008		0.0001					Y			19.3	21	YES		
LITHIUM	149	107			0.77	0.97	1.00	0.0001		0.0001					Y			172.3	17	YES		
MAGNESIUM	149	107			0.97	0.89	0.94	0.0001		0.0001	0.0001				Y			33005.6	42	YES		
MANGANESE	149	107			0.89	0.20	0.10	0.0008		0.0001					Y			626.4	30	YES		
MERCURY	148	107			0.20	0.34	0.27	1.0000		0.9745					Y			0.2	9	YES		
MOLYBDENUM	150	107			0.34	0.38	0.66	0.1779		0.0738					N			195.1	0	NO		
NICKEL	146	107			0.38	0.71	0.94	0.0001		0.0001					Y			97.5	12	YES		
POTASSIUM	150	107			0.71	0.30	0.58	0.4223		0.0001					Y			5178.8	39	YES		
SELENIUM	145	106			0.30	0.99	1.00	0.0011		0.0001	0.0005				Y			127.5	18	YES		
SILICON	84	66			0.99	0.16	0.20	0.0003		0.0258					Y			61390.0	12	YES		
SILVER	147	104			0.16	0.99	1.00	0.0001		0.0017					Y			10.0	9	YES		
SODIUM	149	107			0.99	0.89	1.00	0.0001		0.0001	0.0001				Y			144226.0	26	YES		
STRONTIUM	146	106			0.89	0.24	0.05	1.0000		0.0001					Y			1085.4	33	YES		
THALLIUM	146	107			0.24	0.35	0.19	0.1718		0.5107					N			9.0	0	NO		
TIN	149	106			0.35	0.77	0.74	0.0003		0.2361					N			179.2	3	NO		Not a PCOC by PF (1)
VANADIUM	149	107			0.77	0.91	0.83	0.0008		0.0001					Y			68.2	19	YES		
ZINC	149	107			0.91					0.0001	0.0142				Y			179.2	22	YES		

(1) Professional judgment based on log normal UTL comparison

TABLE A-12
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
UHSU Groundwater Unfiltered Metals
(Slippage Test, Quantile Test, Gehan Test, UTL Comparison)
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	ND	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UTL99	NGUTL	MAX	B	MAX	S	NGM	P	S	P	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL			
ALUMINUM	149	106	8	5	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	3496.5	20830.0	7758.2	53968.8	25624.6	18	63900.0	456000.0	10	0.000	51	35	0.0001	4.719	1.645	0.0001																	
ANTIMONY	141	92	87	77	0.38	0.16	0.16	0.16	0.16	0.16	0.16	0.16	26.8	35.1	10.2	30.3	55.8	7	86.6	194.0	5	0.009	999	999	999	0.0000	2.031	1.645	0.0211																
ARSENIC	138	106	99	51	0.28	0.52	0.52	0.52	0.52	0.52	0.52	0.52	3.9	4.6	1.7	3.0	8.8	6	10.0	18.0	5	0.015	999	999	999	0.0000	5.257	1.645	0.0001																
BARIUM	149	107	39	2	0.74	0.98	0.98	0.98	0.98	0.98	0.98	0.98	105.9	353.7	68.2	608.5	300.4	32	752.0	5060.0	10	0.000	52	47	0.0001	8.551	1.645	0.0001																	
BERYLLIUM	148	100	130	70	0.12	0.30	0.30	0.30	0.30	0.30	0.30	0.30	2.3	3.4	0.6	4.4	5.0	9	5.0	32.0	9	0.000	999	999	999	0.0000	4.077	1.645	0.0001																
CADMIUM	148	106	119	78	0.20	0.26	0.26	0.26	0.26	0.26	0.26	0.26	2.5	3.4	1.0	4.2	11.1	6	11.1	32.9	6	0.005	999	999	999	0.0000	2.104	1.645	0.0177																
CALCIUM	149	107	0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	55030.2	177129.9	31667.8	172674.0	145353.0	32	186000.0	715000.0	24	0.000	52	42	0.0001	10.444	1.645	0.0001																	
CESIUM	142	97	107	95	0.25	0.02	0.02	0.02	0.02	0.02	0.02	0.02	378.2	448.6	195.1	101.5	934.7	0	1000.0	150.0	0	1.000	999	999	999	0.0000	1.089	1.645	0.1380																
CHROMIUM	145	107	75	27	0.48	0.75	0.75	0.75	0.75	0.75	0.75	0.75	13.5	46.9	60.6	91.2	186.4	7	729.0	580.0	0	1.000	51	42	0.0001	6.240	1.645	0.0001																	
COBALT	148	107	124	59	0.16	0.45	0.45	0.45	0.45	0.45	0.45	0.45	21.9	24.1	7.4	27.7	50.0	7	50.0	228.0	7	0.002	999	999	999	0.0000	3.641	1.645	0.0001																
COPPER	148	107	39	49	0.74	0.54	0.54	0.54	0.54	0.54	0.54	0.54	11.4	117.8	11.9	646.9	45.3	20	105.0	6430.0	11	0.000	999	999	999	0.0000	4.018	1.645	0.0001																
IRON	149	106	3	5	0.98	0.95	0.95	0.95	0.95	0.95	0.95	0.95	3909.1	26939.2	9680.1	75639.4	31518.5	18	97000.0	656000.0	7	0.002	51	35	0.0001	4.778	1.645	0.0001																	
LEAD	141	107	43	29	0.70	0.73	0.73	0.73	0.73	0.73	0.73	0.73	3.8	18.5	5.4	39.3	19.3	21	52.5	254.0	10	0.000	50	38	0.0001	4.611	1.645	0.0001																	
LITHIUM	149	107	34	8	0.77	0.93	0.93	0.93	0.93	0.93	0.93	0.93	34.0	85.9	48.5	101.1	172.3	17	266.0	456.0	8	0.001	999	999	999	0.0000	8.382	1.645	0.0001																
MAGNESIUM	149	107	4	0	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	10317.4	52059.5	7954.6	56654.4	33005.6	42	47900.0	235000.0	25	0.000	52	48	0.0001	11.518	1.645	0.0001																	
MANGANESE	149	107	17	6	0.89	0.94	0.94	0.94	0.94	0.94	0.94	0.94	92.4	697.3	187.2	1204.1	626.4	30	1950.0	6200.0	12	0.000	52	42	0.0001	4.532	1.645	0.0001																	
MERCURY	148	107	118	96	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	66.0	61.4	45.3	45.7	195.1	9	0.3	1.5	8	0.001	999	999	999	0.0000	1.951	1.645	0.9745																
MOLYBDENUM	150	107	99	78	0.34	0.27	0.27	0.27	0.27	0.27	0.27	0.27	18.7	52.5	27.6	118.0	97.5	12	334.0	1070.0	2	0.178	999	999	999	0.0000	6.817	1.645	0.0001																
NICKEL	146	107	91	36	0.38	0.66	0.66	0.66	0.66	0.66	0.66	0.66	18.7	52.5	27.6	118.0	97.5	12	334.0	1070.0	2	0.178	999	999	999	0.0000	6.817	1.645	0.0001																
POTASSIUM	150	107	44	6	0.71	0.94	0.94	0.94	0.94	0.94	0.94	0.94	1843.2	5797.4	1169.5	6613.6	5178.8	39	8370.0	38900.0	21	0.000	999	999	999	0.0000	8.295	1.645	0.0001																
SELENIUM	145	106	101	44	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.58	8.5	48.9	41.7	104.3	127.5	18	456.0	475.0	1	0.422	51	36	0.0001	5.289	1.645	0.0001																	
SILICON	84	66	1	0	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	16575.3	40453.3	15401.0	55239.6	61390.0	12	116000.0	288000.0	8	0.001	30	23	0.0001	1.946	1.645	0.0258																	
SILVER	147	104	123	83	0.16	0.20	0.20	0.20	0.20	0.20	0.20	0.20	4.7	59.7	1.0	342.8	10.0	9	10.0	3040.0	9	0.000	999	999	999	0.0000	2.922	1.645	0.0017																
SODIUM	149	107	2	0	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	30081.9	110537.7	40019.7	113020.0	144226.0	26	194000.0	549000.0	18	0.000	52	40	0.0001	9.348	1.645	0.0001																	
STRONTIUM	146	106	16	0	0.89	1.00	1.00	1.00	1.00	1.00	1.00	1.00	312.9	1492.2	270.9	1742.5	1085.4	33	1770.0	6960.0	21	0.000	51	43	0.0001	10.770	1.645	0.0001																	
THALLIUM	146	107	111	102	0.24	0.05	0.05	0.05	0.05	0.05	0.05	0.05	3.9	41	1.8	1.6	9.0	0	10.0	27.0	0	1.000	999	999	999	0.0000	0.027	1.645	0.5107																
TIN	149	106	97	86	0.35	0.19	0.19	0.19	0.19	0.19	0.19	0.19	70.4	82.0	38.2	44.7	179.2	3	200.0	267.0	2	0.172	999	999	999	0.0000	0.719	1.645	0.2361																
VANADIUM	149	107	35	28	0.77	0.74	0.74	0.74	0.74	0.74	0.74	0.74	15.1	57.5	18.6	107.6	68.2	19	167.0	754.0	9	0.000	999	999	999	0.0000	6.708	1.645	0.0001																
ZINC	149	107	14	18	0.91	0.83	0.83	0.83	0.83	0.83	0.83	0.83	37.1	219.9	49.8	850.0	179.2	22	498.0	8000.0	8	0.001	52	39	0.0001	3.747	1.645	0.0001																	

TABLE A-13
ROCKY FLATS OU6
Background Comparison t-Test Results of
UHSU Groundwater Unfiltered Metals
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	ND	B	ND	S	MEAN	B	MEAN	S	STD	B	STD	S	F	CAL	F	TAB	DF	T	CAL	T	1	95	P	T	1	REMARK
ALUMINUM	149	106	8	87	77	3496	5	20830	0	7758	2	53968	8	32	4	3	8	108	3	283	1	66	0	0007						NNDT more than 20%
ANTIMONY	141	92	87	99	51	26	8	35	1	10	2	30	3																	NNDT more than 20%
ARSENIC	138	106	99	39	2	105	9	353	7	68	2	608	5																	NNDT more than 20%
BARIUM	149	107	130	70	78	2	3	3	4	0	6	4	4																	NNDT more than 20%
BERYLLIUM	148	100	130	70	78	2	3	3	4	0	6	4	4																	NNDT more than 20%
CADMIUM	148	106	119	78	0	550	30	2	1771	29	316	67	8	110	9	3	8	111	7	228	1	66	0	0001						NNDT more than 20%
CALCIUM	149	107	0	107	95	378	2	448	6	195	1	101	5																	NNDT more than 20%
CESIUM	142	97	107	75	27	13	5	46	9	60	6	91	2																	NNDT more than 20%
CHROMIUM	145	107	124	59	49	21	9	24	1	7	4	27	7																	NNDT more than 20%
COBALT	148	107	39	49	3	390	9	1	269	39	2	968	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	NNDT more than 20%
COPPER	148	107	3	43	29	3	8	18	5	5	4	39	3																	NNDT more than 20%
IRON	149	106	3	5	390	9	1	269	39	2	968	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	NNDT more than 20%
LEAD	141	107	43	29	3	8	18	5	5	4	39	3																		NNDT more than 20%
LITHIUM	149	107	34	8	34	0	85	9	48	5	101	1																		NNDT more than 20%
MAGNESIUM	149	107	4	0	103	17	4	520	59	5	795	4	6	566	54	4	121	4	3	8	109	7	568	1	66	0	0001			NNDT more than 20%
MANGANESE	149	107	17	6	92	4	697	3	187	2	120	4	1	106	2	3	8	110	5	152	1	66	0	0001						NNDT more than 20%
MERCURY	148	107	118	96	0	1	0	2	0	0	0	2																		NNDT more than 20%
MOLYBDENUM	150	107	99	78	36	66	0	61	4	45	3	45	7																	NNDT more than 20%
NICKEL	146	107	91	36	18	7	52	5	27	6	118	0																		NNDT more than 20%
POTASSIUM	150	107	44	6	184	3	2	579	7	4	116	9	5	661	3	6														NNDT more than 20%
SELENIUM	145	106	101	44	8	5	48	9	41	7	10	4	3																	NNDT more than 20%
SILICON	84	66	1	0	165	75	3	404	53	3	154	0	0	552	39	6	39	1	73	3	409	1	67	0	0005					NNDT more than 20%
SILVER	147	104	123	83	4	7	59	7	1	0	342	8																		NNDT more than 20%
SODIUM	149	107	2	0	300	81	9	1105	37	7	400	19	7	1130	20	3	79	6	3	8	125	7	053	1	65	0	0001			NNDT more than 20%
STRONTIUM	146	106	16	0	312	9	149	22	270	9	174	2	5	104	7	3	8	109	6	908	1	66	0	0001						NNDT more than 20%
THALLIUM	146	107	111	102	3	9	4	1	18	1	6																			NNDT more than 20%
TIN	149	106	97	86	70	4	82	0	38	2	44	7																		NNDT more than 20%
VANADIUM	149	107	35	28	15	1	57	5	18	6	107	6																		NNDT more than 20%
ZINC	149	107	14	18	37	1	219	9	49	8	850	0																		NNDT more than 20%

NNDT = Number of non-detects

TABLE A-14
ROCKY FLATS OU6
Background Comparison Summary of
UHSU Groundwater Filtered Metals
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	DTF B	DTF S	P	SLIP	P	QUAN	P	GEHAN	P	T	I	SIGNIF(CT	UTL99	NGUTL	PCOC	REMARK
ALUMINUM	248	191			0.77	0.43		1.0000				0.5488				N	1816.5	1	YES	
ANTIMONY	248	189			0.48	0.20		0.0011				0.1747				Y	51.2	8	YES	
ARSENIC	219	191			0.07	0.12		1.0000				0.6269				N	15.0	0	NO	
BARIUM	256	191			0.71	0.97		0.0001				0.0001				Y	176.5	30	YES	
BERYLLIUM	212	191			0.10	0.05		1.0000				0.9994				N	5.0	0	NO	
CADMIUM	240	189			0.22	0.11		0.1935				0.9885				N	5.1	4	YES	
CALCIUM	257	191			1.00	1.00		0.0001		0.0001		0.0001	0.0001			Y	148383.0	50	YES	
CESIUM	211	174			0.21	0.05		1.0000				0.9990				N	1122.4	0	NO	
CHROMIUM	250	189			0.36	0.26		0.0026				0.2697				Y	15.0	15	YES	
COBALT	231	191			0.18	0.14		1.0000				0.9689				N	50.0	0	NO	
COPPER	250	190			0.39	0.29		1.0000				0.7052				N	53.8	4	YES	
IRON	256	188			0.76	0.45		1.0000				0.5773				N	1682.7	6	YES	
LEAD	250	191			0.23	0.04		1.0000				0.9999				N	15.8	0	NO	
LITHIUM	250	191			0.74	0.91		0.0001				0.0001				Y	190.7	25	YES	
MAGNESIUM	254	191			0.94	1.00		0.0001		0.0001		0.0001	0.0001			Y	33721.2	65	YES	
MANGANESE	256	191			0.61	0.65		0.0001		0.0001		0.0012				Y	282.1	42	YES	
MERCURY	206	191			0.10	0.01		1.0000				1.0000				N	0.7	0	NO	
MOLYBDENUM	241	189			0.37	0.21		1.0000				0.3284				N	188.1	0	NO	
NICKEL	236	191			0.33	0.37		0.0034				0.0001				Y	35.4	7	YES	
POTASSIUM	252	191			0.72	0.85		0.4312				0.0001				Y	4683.9	25	YES	
SELENIUM	219	191			0.32	0.59		1.0000		0.0001		0.0001				Y	136.8	29	YES	
SILICON																				NO BKGD measurement
SILVER	236	190			0.29	0.10		1.0000				0.9965				N	2586.6	0	NO	
SODIUM	255	191			0.99	1.00		0.0001		0.0001		0.0001	0.0001			Y	156322.0	47	YES	
STRONTIUM	253	191			0.92	1.00		1.0000		0.0001		0.0001	0.0001			Y	1968.2	31	YES	
THALLIUM	213	191			0.22	0.04		1.0000				0.9961				N	72.1	0	NO	
TIN	236	190			0.43	0.18		1.0000				0.9664				N	1734.3	0	NO	
VANADIUM	249	191			0.65	0.36		1.0000				0.8380				N	40.7	0	NO	
ZINC	256	191			0.79	0.51		0.0327				0.9799				Y	64.8	11	YES	

TABLE A-15
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
UHSU Groundwater Filtered Metals
(Slippage Test Quantile Test, Gehan Test UTL Comparison)
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	ND	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UTL99	NGUTL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL	
ALUMINUM	248	191			36	109	0.77	0.43					113.0		94.3		597.3		347.2		1816.5		1		86100		48300		0	1.000		999		999	00000	0	123	1645		0	5488	
ANTIMONY	248	189			128	151	0.48	0.20					24.5		28.1		9.4		19.1		51.2		8		600		1620		8	0.001		999		999	00000	0	936	1645		0	1747	
ARSENIC	219	191			203	168	0.07	0.12					4.4		3.9		1.6		1.7		15.0		0		150		40		0	1.000		999		999	00000	0	324	1645		0	6269	
BARIUM	256	191			73	6	0.71	0.97					87.4		1200		31.2		63.6		176.5		30		2030		2860		26	0.000		999		999	00000	7	171	1645		0	0001	
BERYLLIUM	212	191			190	181	0.10	0.05					2.3		2.1		0.6		0.8		5.0		0		50		20		0	1.000		999		999	00000	3	231	1645		0	9994	
CADMIUM	240	189			187	169	0.22	0.11					2.6		2.4		0.9		1.3		5.1		4		86		139		2	0.194		999		999	00000	2	274	1645		0	9885	
CALCIUM	257	191			1	0	1.00	1.00					55208.7		161556.0		32667.6		157988.0		148383.0		50		1840000		6590000		36	0.000		90		71	0	0001	12	955	1645		0	0001
CESIUM	211	174			167	166	0.21	0.05					443.8		407.9		237.9		159.6		1122.4		0		25000		1600		0	1.000		999		999	00000	3	094	1645		0	9990	
CHROMIUM	250	189			160	139	0.36	0.26					60		67		3.1		6.7		15.0		15		23.2		460		7	0.003		999		999	00000	0	614	1645		0	2697	
COBALT	231	191			189	164	0.18	0.14					20.9		17.7		8.4		10.2		50.0		0		500		133		0	1.000		999		999	00000	1	865	1645		0	9689	
COPPER	250	190			152	134	0.39	0.29					10.7		10.9		15.1		10.6		53.8		4		1750		819		0	1.000		999		999	00000	0	539	1645		0	7052	
IRON	256	188			62	103	0.76	0.45					93.7		1930		557.1		597.9		1682.7		6		87900		55000		0	1.000		999		999	00000	0	195	1645		0	5773	
LEAD	250	191			192	184	0.23	0.04					2.4		1.4		4.7		0.5		15.8		0		640		34		0	1.000		999		999	00000	3	767	1645		0	9999	
LITHIUM	250	191			64	18	0.74	0.91					38.0		75.2		53.6		107.2		190.7		25		2500		6500		20	0.000		999		999	00000	8	450	1645		0	0001	
MAGNESIUM	254	191			15	0	0.94	1.00					9991.4		47941.6		8319.8		56083.1		33721.2		65		463000		2570000		41	0.000		89		83	0	0001	14	199	1645		0	0001
MANGANESE	256	191			101	66	0.61	0.65					32.7		344.5		87.4		892.1		282.1		42		9340		45200		17	0.000		90		55	0	0001	3	026	1645		0	0012
MERCURY	206	191			186	190	0.10	0.01					0.1		0.1		0.1		0.0		0.7		0		0.7		0.3		0	1.000		999		999	00000	-4	063	1645		0	10000	
MOLYBDENUM	241	189			151	149	0.37	0.21					56.1		60.5		46.3		46.1		188.1		0		2000		484		0	1.000		999		999	00000	0	444	1645		0	3284	
NICKEL	236	191			159	120	0.33	0.37					15.4		21.5		7.0		38.1		35.4		7		400		2950		7	0.003		999		999	00000	4	587	1645		0	0001	
POTASSIUM	252	191			70	28	0.72	0.85					1574.3		26080		1090.3		1666.3		4683.9		25		81100		94500		1	0.431		999		999	00000	8	413	1645		0	0001	
SELENIUM	219	191			149	79	0.32	0.59					9.2		46.2		44.8		96.0		136.8		29		6070		4600		0	1.000		82		66	0	0001	6	376	1645		0	0001
SILICON(1)	0	122			0	0		1.00																																		
SILVER	236	190			168	171	0.29	0.10					62.5		4.4		885.0		1.4		2586.6		0		136000		10.2		0	1.000		999		999	00000	2	696	1645		0	9965	
SODIUM	255	191			3	0	0.99	1.00					31887.5		117400.0		43627.7		127532.0		156322.0		47		2520000		8970000		29	0.000		90		74	0	0001	12	142	1645		0	0001
STRONTIUM	253	191			21	0	0.92	1.00					353.8		1407.5		566.0		1718.7		1968.2		31		79300		70000		0	1.000		89		73	0	0001	13	344	1645		0	0001
THALLIUM	213	191			166	184	0.22	0.04					5.9		40		23.2		1.7		72.1		0		3280		2.4		0	1.000		999		999	00000	2	662	1645		0	9961	
TIN	236	190			135	156	0.43	0.18					102.3		70.8		572.2		39.9		1734.3		0		88300		1290		0	1.000		999		999	00000	1	830	1645		0	9664	
VANADIUM	249	191			88	122	0.65	0.36					11.8		13.8		10.1		10.4		40.7		0		500		27.3		0	1.000		999		999	00000	0	986	1645		0	8380	
ZINC	256	191			54	93	0.79	0.51					14.4		18.2		17.7		37.8		64.8		11		1370		3140		4	0.033		999		999	00000	2	052	1645		0	9799	

(1) No background measurement

TABLE A-16
ROCKY FLATS OU6
Background Comparison t-Test Results of
UHSU Groundwater Filtered Metals
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	N	D	B	N	D	S	MEAN B	MEAN S	STD B	STD S	F	CAL	F	1 AB	DF	T	CAL	T	1	95	P	T	1	REMARK
ALUMINUM	248	191	56	109	113.0	94.3	597.3	347.2																				NNDT more than 20%
ANTIMONY	248	189	128	151	24.5	28.1	9.4	19.1																				NNDT more than 20%
ARSENIC	219	191	203	168	4.4	3.9	1.6	1.7																				NNDT more than 20%
BARIUM	256	191	73	6	87.4	120.0	31.2	63.6																				NNDT more than 20%
BERYLLIUM	212	191	190	181	2.3	2.1	0.6	0.8																				NNDT more than 20%
CADMIUM	240	189	187	169	2.6	2.4	0.9	1.3																				NNDT more than 20%
CALCIUM	257	191	1	0	55208.7	161556.0	32667.6	157987.7	132.0	3.8	202	9.159	1.65	0.0001														NNDT more than 20%
CESIUM	211	174	167	166	443.8	407.9	237.9	159.6																				NNDT more than 20%
CHROMIUM	250	189	160	139	6.0	6.7	3.1	6.7																				NNDT more than 20%
COBALT	231	191	189	164	20.9	17.7	8.4	10.2																				NNDT more than 20%
COPPER	250	190	152	134	10.7	10.9	15.1	10.6																				NNDT more than 20%
IRON	256	188	62	103	93.7	193.0	557.1	597.9																				NNDT more than 20%
LEAD	250	191	192	184	2.4	1.4	4.7	0.5																				NNDT more than 20%
LITHIUM	250	191	64	18	38.0	75.2	53.6	107.2																				NNDT more than 20%
MAGNESIUM	254	191	15	0	9991.4	47941.6	8319.8	56083.1	162.3	3.8	196	9.275	1.65	0.0001														NNDT more than 20%
MANGANESE	256	191	101	66	32.7	344.5	87.4	892.1																				NNDT more than 20%
MERCURY	206	191	186	190	0.1	0.1	0.1	0.0																				NNDT more than 20%
MOLYBDENUM	241	189	151	149	56.1	60.5	46.3	46.1																				NNDT more than 20%
NICKEL	236	191	159	120	15.4	21.5	7.0	38.1																				NNDT more than 20%
POTASSIUM	252	191	70	28	1574.3	2608.0	1090.3	1666.3																				NNDT more than 20%
SELENIUM	219	191	149	79	9.2	46.2	44.8	96.0																				NNDT more than 20%
SILICON	0	122	0	0	7186.0	7186.0	1896.1																					NNDT more than 20%
SILVER	236	190	168	171	62.5	4.4	885.0	1.4																				NNDT more than 20%
SODIUM	255	191	3	0	31887.5	117400.0	43627.7	127532.2	99.9	3.8	223	8.885	1.65	0.0001														NNDT more than 20%
STRONTIUM	253	191	21	0	353.8	1407.5	566.0	1718.7	116.6	3.8	221	8.146	1.65	0.0001														NNDT more than 20%
THALLIUM	213	191	166	184	5.9	4.0	23.2	1.7																				NNDT more than 20%
TIN	236	190	135	156	102.3	70.8	572.2	39.9																				NNDT more than 20%
VANADIUM	249	191	88	122	11.8	13.8	10.1	10.4																				NNDT more than 20%
ZINC	256	191	54	93	14.4	18.2	17.7	37.8																				NNDT more than 20%

NNDT = Number of non-detects

TABLE A-17
ROCKY FLATS OU6
Background Comparison Summary of
UHSU Groundwater Unfiltered Radionuclides
(Concentration Unit pCi/L)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	1	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
AMERICIUM 241	183	131			1 00	1 00	1 00	0 0020	0 0018	0 0151								Y	0 037	16	YES	
CESIUM-137	156	68			1 00	1 00	1 00	0 0912	0 3756	0 1002								N	1 065	2	YES	
GROSS ALPHA	23	7			1 00	1 00	1 00	1 0000	0 1201	0 0775								N	390 578	0	NO	
GROSS BETA	23	7			1 00	1 00	1 00	1 0000	0 1201	0 1056								N	221 307	0	NO	
PLUTONIUM 239 240	194	138			1 00	1 00	1 00	0 0003	0 0001	0 0001								Y	0 064	12	YES	
RADIUM 226	6	6			1 00	1 00	1 00	0 0303	0 0909	0 0547								Y	1 295	1	YES	
RADIUM 228	0	3			0 00	0 00	0 00															NO BKGD measurement
STRONTIUM 89 90(1)	32	3			1 00	1 00	1 00	0 0857	0 0952	0 0259								Y	1 154	1	YES	
TRITIUM	84	238			1 00	1 00	1 00	1 0000	0 3271	0 1193								N	12982 300	0	NO	
URANIUM TOTAL	0	0			0 00	0 00	0 00															NO measurements
URANIUM-233 234(1)	35	4			1 00	1 00	1 00	1 0000	1 0000	0 3730								N	144 836	0	NO	
URANIUM-235(1)	35	4			1 00	1 00	1 00	1 0000	1 0000	0 7981								N	5 233	0	NO	
URANIUM-238(1)	22	4			1 00	1 00	1 00	1 0000	0 6759	0 1776								N	114 171	0	NO	

(1) Sample size is too small

TABLE A-18
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
UHSU Groundwater Unfiltered Radionuclides
(Slippage Test Quantile Test, Gehan Test, UTL Comparison)
(Concentration Unit pCi/L)

ANALYTE	N	B	N	S	ND	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UTL99	NGI/TL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL
AMERICIUM 241	183	131	0	0	0	1.00	1.00	0.050	0.011	0.297	0.037	16	0.097	3.200	7	0.0020	63	37	0.0018	2.166	1.645	0.0151																			
CESIUM 137	156	68	0	0	0	1.00	1.00	0.120	0.231	0.628	1.065	2	1.160	4.499	2	0.0912	45	15	0.3756	1.280	1.645	0.1002																			
GROSS ALPHA	23	7	0	0	0	1.00	1.00	43.497	94.285	99.739	390.578	0	362.000	280.000	0	1.0000	6	3	0.1201	1.422	1.645	0.0775																			
GROSS BETA	23	7	0	0	0	1.00	1.00	24.945	40.003	53.342	221.307	0	220.000	160.000	0	1.0000	6	3	0.1201	1.251	1.645	0.1056																			
PLUTONIUM 239,240	194	138	0	0	0	1.00	1.00	0.004	0.081	0.388	0.064	12	0.224	3.650	9	0.0003	67	44	0.0001	5.104	1.645	0.0001																			
RADIUM 226	6	6	0	0	0	1.00	1.00	0.355	2.070	0.128	3.319	1	0.520	8.800	4	0.0303	3	3	0.0909	1.601	1.645	0.0547																			
RADIUM 228(1)	0	3	0	0	0																																				
STRONTIUM 89,90	32	3	0	0	0	1.00	1.00	0.215	0.837	0.563	1.154	1	1.120	1.220	1	0.0857	7	2	0.0952	1.945	1.645	0.0259																			
TRITIUM	84	238	0	0	0	1.00	1.00	624.852	216.280	42.46750	12982.300	0	39030.000	1088.650	0	1.0000	65	50	0.3271	1.179	1.645	0.1193																			
URANIUM TOTAL(2)	0	0	0	0	0																																				
URANIUM 233,234	35	4	0	0	0	1.00	1.00	15.618	4.313	38.753	144.836	0	164.000	9.700	0	1.0000	8	0	1.0000	0.324	1.645	0.3730																			
URANIUM 235	35	4	0	0	0	1.00	1.00	0.617	0.095	1.384	5.233	0	6.290	0.170	0	1.0000	8	0	1.0000	-0.835	1.645	0.7981																			
URANIUM 238	22	4	0	0	0	1.00	1.00	10.840	3.985	27.727	114.171	0	108.000	9.400	0	1.0000	6	1	0.6759	0.925	1.645	0.1776																			

(1) No detect record from site
(2) No background measurement

TABLE A-19
ROCKY FLATS OU6
Background Comparison Summary of
UHSU Groundwater Filtered Radionuclides
(Concentration Unit pCi/L)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	1	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
AMERICIUM-241	2	4	100	100	100	0.4000	0.4000	0.4000	0.4000	0.4000	0.3217	N	N	10 068	0	NO(1)						
CESIUM-137	38	12	100	100	100	1.0000	0.7636	0.6161	N	N	2 143	0	NO									
GROSS ALPHA	213	167	100	100	100	1.0000	0.0001	0.0001	Y	Y	100 522	0	YES									
GROSS BETA	196	177	100	100	100	1.0000	0.0001	0.0001	Y	Y	39 774	4	YES									
PLUTONIUM-239 240	1	4	100	100	100	0.8000	0.8000	0.7602	N	N	0 011	1	YES(1)									
RADIUM-226	36	85	100	100	100	0.0001	0.0001	0.0001	Y	Y	0 626	18	YES									
RADIUM 228	6	18	100	100	100	0.5543	0.8609	0.9713	N	N	5 935	1	NO	Not a PCOC by PJ								
STRONTIUM-89 90	180	128	100	100	100	0.4156	0.0004	0.0007	Y	Y	1 210	4	YES									
TRITIUM	165	0	0.00	0.00	0.00																	NO site measurement
URANIUM TOTAL	0	0	0.00	0.00	0.00																	NO measurements
URANIUM-233 234	207	172	100	100	100	1.0000	0.0001	0.0001	Y	Y	79 470	0	YES									
URANIUM-235	207	172	100	100	100	1.0000	0.0001	0.0001	Y	Y	2 006	2	YES									
URANIUM-238	177	172	100	100	100	1.0000	0.0001	0.0001	Y	Y	55 240	0	YES									

(1) Sample size is too small

(2) Professional judgment based on log-normal UTL comparison

TABLE A-20
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
UHSU Groundwater Filtered Radionuclides
(Slippage Test, Quantile Test, Gehan Test, UTL Comparison)
(Concentration Unit pCi/L)

ANALYTE	N	B	N	S	ND	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UTL99	NGUTL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL
AMERICIUM 241	2	4	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.011	0.129	0.011	0.228	10.068	0	0.019	0.471	2	0.4000	2	0.4000	0.463	1.645	0.3217														
CESIUM 137	38	12	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.420	0.348	0.525	0.389	2.143	0	2.600	1.160	0	1.0000	10	2	0.7636	0.295	1.645	0.6161													
GROSS ALPHA	213	167	0	0	0	0	0	0	1.00	1.00	1.00	1.00	8.354	16.928	32.315	17.208	100.522	0	312.700	74.490	0	1.0000	76	62	0.0001	9.523	1.645	0.0001													
GROSS BETA	196	177	0	0	0	0	0	0	1.00	1.00	1.00	1.00	4.892	10.299	12.230	10.858	39.774	4	135.900	90.000	0	1.0000	75	62	0.0001	8.790	1.645	0.0001													
PLUTONIUM 239 240	1	4	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.011	0.035	0.067	0.011	1	0.011	0.136	1	0.8000	1	1	0.8000	0.707	1.645	0.7602														
RADIUM 226	36	85	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.258	0.475	0.111	0.225	0.626	18	0.530	1.199	29	0.0001	25	25	0.0001	5.355	1.645	0.0001													
RADIUM 228	6	18	0	0	0	0	0	0	1.00	1.00	1.00	1.00	2.122	1.614	0.520	1.888	5.935	1	3.000	7.700	2	0.5543	6	4	0.8609	1.901	1.645	0.9713													
STRONTIUM-89 90	180	128	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.338	0.449	0.306	0.359	1.210	4	1.800	1.804	1	0.4156	62	38	0.0004	3.196	1.645	0.0007													
TRITIUM(1)	165	0	0	0	0	0	0	0																																	
URANIUM,TOTAL(2)	0	0	0	0	0	0	0	0																																	
URANIUM 233 234	207	172	0	0	0	0	0	0	1.00	1.00	1.00	1.00	6.914	12.997	25.439	13.602	79.470	0	199.500	63.000	0	1.0000	76	61	0.0001	9.997	1.645	0.0001													
URANIUM 235	207	172	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.195	0.438	0.635	0.491	2.006	2	4.803	2.100	0	1.0000	76	60	0.0001	8.501	1.645	0.0001													
URANIUM 238	177	172	0	0	0	0	0	0	1.00	1.00	1.00	1.00	4.832	9.395	17.673	9.620	55.240	0	135.600	39.000	0	1.0000	70	61	0.0001	9.916	1.645	0.0001													

(1) No site measurement

(2) No background measurement

TABLE A-21
ROCKY FLATS OU6
Background Comparison Summary of
Pond Sediments Metals
(Concentration Unit MG/KG)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	I	SIGNIFIC	UTL99	NGUTL	PCOC	REMARK
ALUMINUM	20	57			1.00	1.00	0.4000	0.3476	0.1135	0.2025	N	29553.4	0	NO								
ANTIMONY	18	28			0.44	0.39	0.6087	0.3327			N	55.0	1	YES								
ARSENIC	20	57			0.90	1.00	1.0000	0.5749	0.9802		N	66.7	0	NO								
BARIUM	20	57			1.00	1.00	1.0000	0.9300	0.5577	0.8872	N	794.9	0	NO								
BERYLLIUM	16	57			0.81	0.98	0.3629	0.1331			N	5.6	4	NO								Not a PCOC by PJ (I)
CADMIUM	16	56			0.88	0.39	0.6025	0.9911			N	8.8	1	NO								Not a PCOC by PJ (I)
CALCIUM	20	57			1.00	1.00	0.7403	0.9300	0.4400	0.7545	N	80941.3	0	NO								
CESIUM	17	57			1.00	0.93	1.0000	1.0000			N	1259.1	0	NO								
CHROMIUM	18	57			1.00	1.00	0.0377	0.0704	0.0172		Y	31.2	6	YES								
COBALT	19	57			0.95	1.00	1.0000	0.8358	0.0340	0.3018	Y	35.1	0	YES								
COPPER	19	57			1.00	1.00	1.0000	0.6377	0.0047	0.3555	Y	174.7	0	YES								
IRON	19	57			1.00	1.00	1.0000	0.9440	0.0235	0.8936	Y	143862.0	0	YES								
LEAD	19	57			1.00	1.00	1.0000	0.9859	0.7115	0.8849	N	261.1	0	NO								
LITHIUM	18	57			1.00	0.98	1.0000	0.9875			N	106.7	0	NO								
MAGNESIUM	20	57			1.00	1.00	0.0785	0.0365	0.0001	0.0001	Y	6328.5	0	YES								
MANGANESE	20	57			0.70	1.00	1.0000	0.9300	0.0238		Y	1993.1	0	YES								
MERCURY	15	56			1.00	0.43	0.7887	0.9467	0.9994		N	1.7	0	NO								NO site measurement
MOLYBDENUM																						
NICKEL	17	56			1.00	1.00	0.7671	0.5169	0.1637		N	44.3	1	NO								Not a PCOC by PJ (I)
POTASSIUM	18	56			1.00	0.89	0.0496	0.0662	0.0008		Y	3872.2	0	YES								
SELENIUM	19	57			0.89	0.05	1.0000	1.0000			N	5.3	0	NO								
SILICON																						NO site measurement
SILVER	15	57			0.87	0.39	0.0054	0.0191	0.3114		Y	11.5	19	YES								
SODIUM	20	57			0.85	1.00	1.0000	0.5983	0.0119	0.5326	Y	2610.3	0	YES								
STRONTIUM	20	57			1.00	1.00	1.0000	0.9962	0.8340	0.9479	N	621.7	0	NO								
THALLIUM	13	56			0.69	0.39	1.0000	1.0000			N	13.6	0	NO								
TIN	19	56			0.95	0.02	1.0000		0.9953		N	103.3	0	NO								
VANADIUM	19	57			1.00	1.00	0.7500	0.6377	0.0028	0.0762	Y	83.0	0	YES								
ZINC	20	57			1.00	1.00	0.0001	0.0042	0.0001	0.0001	Y	143.0	19	YES								

(1) Professional judgement based on log normal UTL comparison

TABLE A-22
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
Pond Sediment Metals
(Slippage Test, Gehan Test UTL Comparison)
(Concentration Unit MG/KG)

ANALYTE	N	B	N	S	N	D	B	N	D	S	D	T	F	B	D	T	F	S	MEAN B	MEAN S	STD B	STD S	UTL99	NGUT1	MAX B	MAX S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL
ALUMINUM	20	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	10354.3	11428.5	5010.7	4909.6	2953.4	0	21600.0	27400.0	3	0.4000	16	13	0.3476	1.208	1.645	0.1135							
ANTIMONY	18	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	12.6	16.1	10.7	15.1	55.0	1	60.0	68.5	1	0.6087	999	999	999	999	0.0000	0.432	1.645	0.3327					
ARSENIC	20	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	12.9	16.1	10.7	15.1	66.7	0	49.2	10.2	0	1.0000	999	999	999	999	0.0000	-0.189	1.645	0.5749					
BARIUM	20	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	207.9	164.7	153.2	31.7	794.9	0	706.0	254.0	0	1.0000	16	10	0.9300	-0.145	1.645	0.5777							
BERYLLIUM	16	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	1.4	1.8	1.0	2.5	5.6	4	5.0	15.2	4	0.3629	999	999	999	999	0.0000	1.112	1.645	0.1331					
CADMIUM	16	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	2.3	1.7	1.6	2.0	8.8	1	6.1	9.9	2	0.6025	999	999	999	999	0.0000	2.371	1.645	0.9911					
CALCIUM	20	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	19407.5	16698.9	16059.6	11030.5	80941.3	0	61000.0	68100.0	1	0.7403	16	10	0.9300	0.151	1.645	0.4400							
CESIUM	17	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	341.6	9.6	227.3	25.1	1259.1	0	725.0	5.8	0	1.0000	999	999	999	999	0.0000	-6.426	1.645	1.0000					
CHROMIUM	18	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	11.2	17.8	5.0	15.3	31.2	6	22.5	96.1	11	0.0377	15	14	0.0704	2.115	1.645	0.0172							
COBALT	19	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	9.5	10.3	6.6	1.8	35.1	0	27.3	15.5	0	1.0000	16	11	0.8358	1.825	1.645	0.0340							
COPPER	19	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	27.5	30.1	37.8	21.5	174.7	0	178.0	125.0	0	1.0000	16	12	0.6377	2.597	1.645	0.0047							
IRON	19	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	25565.8	16540.2	30391.4	3541.4	143861.5	0	112000.0	26500.0	0	1.0000	16	10	0.9440	1.985	1.645	0.0235							
LEAD	19	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	47.9	36.4	54.8	27.0	261.1	0	255.0	155.0	0	1.0000	16	9	0.9859	-0.558	1.645	0.7115							
LITHIUM	18	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	21.6	8.3	21.5	3.1	106.7	0	70.2	16.6	0	1.0000	999	999	999	999	0.0000	2.240	1.645	0.9875					
MAGNESIUM	20	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	2446.8	3536.0	1013.1	846.5	6328.5	0	4730.0	5650.0	8	0.0785	16	15	0.0365	4.235	1.645	0.0001							
MANGANESE	20	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	318.0	283.2	437.2	85.6	1993.1	0	1740.0	558.0	0	1.0000	16	10	0.9300	1.981	1.645	0.0238							
MERCURY	15	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	0.3	0.2	0.3	0.3	1.7	0	1.3	1.5	1	0.7887	15	10	0.9467	3.261	1.645	0.9994							
MOLYBDENUM(1)																																									
NICKEL	17	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	13.9	15.4	7.5	10.0	44.3	1	29.9	58.1	1	0.7671	15	12	0.5169	0.979	1.645	0.1637							
POTASSIUM	18	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	1299.8	1924.1	649.5	784.6	3872.2	0	2730.0	3540.0	10	0.0496	15	14	0.0662	3.175	1.645	0.0008							
SELENIUM	19	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	1.5	0.5	1.0	0.2	5.3	0	3.5	1.9	0	1.0000	999	999	999	999	0.0000	5.405	1.645	1.0000					
SILICON(1)																																									
SILVER	15	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	2.7	39.6	2.1	80.9	11.5	19	6.8	345.0	19	0.0054	15	15	0.0191	0.492	1.645	0.3114							
SODIUM	20	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	370.6	359.7	584.5	157.9	2610.3	0	2730.0	761.0	0	1.0000	16	12	0.5983	2.260	1.645	0.0119							
STRONTIUM	20	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	129.7	80.0	128.4	41.1	621.7	0	546.0	307.0	0	1.0000	16	8	0.9962	-0.970	1.645	0.8340							
THALLIUM	13	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	2.0	0.8	2.6	0.2	13.6	0	9.2	0.9	0	1.0000	999	999	999	999	0.0000	-4.156	1.645	1.0000					
TIN	19	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	27.6	20.3	19.4	2.6	103.3	0	70.2	39.5	0	1.0000	999	999	999	999	0.0000	2.599	1.645	0.9953					
TUNGSTEN	19	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	27.6	32.8	14.2	9.5	83.0	0	61.2	62.7	1	0.7500	16	12	0.6377	2.765	1.645	0.0028							
VANADIUM	19	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	27.6	32.8	14.2	9.5	83.0	0	61.2	62.7	1	0.7500	16	12	0.6377	2.765	1.645	0.0028							
ZINC	20	28	10	17	0	0	0	0	0	0	100	0.44	0.39	100	0.44	0.39	100	0.44	56.1	165.8	22.7	181.1	143.0	19	112.0	1270.0	30	0.0001	16	16	0.0042	5.321	1.645	0.0001							

(1) No site measurement

TABLE A-23
ROCKY FLATS OU6
Background Comparison Summary of
Pond Sediment Radionuclides
(Concentration Unit pCi/G)

ANALYTE	N	B	N	S	DTI	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	1	SIGNIFICT	UTI99	NGUTL	PCOC	REMARK
AMERICIUM 241	14	48	1.00	1.00	1.00	0.0005	0.0232	0.0001	Y	1 472	22	YES										
CESIUM 137	13	46	1.00	1.00	1.00	1.0000	0.9833	0.9966	N	3 510	0	NO										
GROSS ALPHA	15	55	1.00	1.00	1.00	0.0062	0.0225	0.0016	Y	78 829	9	YES										
GROSS BETA	14	56	1.00	1.00	1.00	0.0688	0.4299	0.0006	Y	45 966	3	YES										
PLUTONIUM 239,240	16	47	1.00	1.00	1.00	0.0018	0.0134	0.0001	Y	7 678	17	YES										
RADIUM 226	9	5	1.00	1.00	1.00	0.0005	0.0050	0.0013	Y	1 973	0	YES										
RADIUM 228	9	5	1.00	1.00	1.00	0.0005	0.0275	0.0013	Y	2 884	0	YES										
STRONTIUM 89,90	14	25	1.00	1.00	1.00	0.6410	0.7033	0.0188	Y	2 649	0	YES										
TRITIUM (1)	13	41	1.00	1.00	1.00	0.4298	0.1853	0.7110	N	769 750	2	NO	Not a PCOC by PJ (2)									
URANIUM TOTAL	0	0	0.00	0.00	0.00																	NO HIT
URANIUM 233,234	16	50	1.00	1.00	1.00	0.0001	0.0121	0.0001	Y	2 389	8	YES										
URANIUM 235	17	50	1.00	1.00	1.00	0.2194	0.0712	0.0015	Y	0 248	5	YES										
URANIUM 238	14	50	1.00	1.00	1.00	0.0016	0.0270	0.0001	Y	2 540	8	YES										

(1) Concentration Unit pCi/L

(2) Professional judgment based on log normal UTL comparison

TABLE A-24
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
Pond Sediment Radionuclides
(Slippage Test, Quantile Test, Gehan Test, UTL Comparison)
(Concentration Unit pCi/G)

ANALYTE	N	B	N	S	ND	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UTL99	NGUTL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL
AMERICIUM 241	14	55	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.127	0.812	0.447	0.603	0.507	63.598	1.472	29	1.072	389.400	30	0.0001	14	14	0.0282	4.864	1.645	0.0001											
CESIUM 137	13	57	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.812	0.447	0.603	0.512	3.510	0	2.300	2.810	1	0.8143	14	9	0.9827	2.651	1.645	0.9960													
GROSS ALPHA	15	57	0	0	0	0	0	0	1.00	1.00	1.00	1.00	19.709	106.743	14.002	261.135	78.829	10	47.600	173.000	19	0.0054	15	15	0.0191	3.030	1.645	0.0012													
GROSS BETA	14	57	0	0	0	0	0	0	1.00	1.00	1.00	1.00	23.728	31.807	5.080	12.186	45.966	4	32.500	98.170	12	0.0552	15	13	0.3854	3.281	1.645	0.0005													
PLUTONIUM 239 240	16	50	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.613	16.252	1.713	32.798	7.678	19	6.667	180.200	20	0.0012	14	14	0.0121	4.893	1.645	0.0001													
RADIUM 226	9	9	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.705	0.879	0.235	0.086	1.973	0	1.100	1.016	0	1.0000	4	3	0.2882	2.253	1.645	0.0121													
RADIUM 228	9	9	0	0	0	0	0	0	1.00	1.00	1.00	1.00	1.179	1.622	0.316	0.147	2.884	0	1.600	1.835	5	0.0147	4	4	0.0412	2.693	1.645	0.0035													
STRONTIUM 89 90	14	25	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.353	0.446	0.525	0.441	2.649	0	1.727	1.800	1	0.6410	8	5	0.7033	2.079	1.645	0.0188													
TRITIUM	13	50	0	0	0	0	0	0	1.00	1.00	1.00	1.00	198.538	220.083	127.731	325.297	769.750	3	540.000	1729.000	5	0.3014	13	12	0.1847	-0.764	1.645	0.7777													
URANIUM TOTAL (1)	0	0	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.822	3.232	0.380	4.618	2.389	13	1.427	25.220	34	0.0001	15	15	0.0141	4.727	1.645	0.0001													
URANIUM 233 234	16	56	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.039	0.153	0.052	0.250	0.248	10	0.212	1.302	10	0.0573	15	14	0.0790	3.328	1.645	0.0004													
URANIUM 235	17	56	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.733	4.331	0.413	7.736	2.540	13	1.610	43.090	27	0.0004	14	14	0.0300	5.066	1.645	0.0001													
URANIUM 238	14	56	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.733	4.331	0.413	7.736	2.540	13	1.610	43.090	27	0.0004	14	14	0.0300	5.066	1.645	0.0001													

(1) No Background measurement

TABLE A-25
ROCKY FLATS OU6
Background Comparison Summary of
Pond Surface Water Unfiltered Metals
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	I	SIGNIFIC	UTL99	NGUTL	PCOC	REMARK
ALUMINUM	44	49			0.91		0.98	1.0000	1.0000			1.0000	1.0000	0.9937	N				176057.0	0	NO	
ANTIMONY	30	51			0.37		0.06	1.0000						0.9952	N				448.7	0	NO	
ARSENIC	40	51			0.65		0.41	1.0000						0.9996	N				727.5	0	NO	
BARIUM	40	51			0.83		1.00	1.0000	1.0000					1.0000	0.9992	N			6697.9	0	NO	
BERYLLIUM	34	51			0.38		0.04	1.0000						0.9983	N				14.6	0	NO	
CADMIUM	29	51			0.34		0.22	1.0000						1.0000	N				73.2	0	NO	
CALCIUM	48	51			1.00		1.00	1.0000	1.0000					1.0000	0.9997	N			521669.0	0	NO	
CESIUM	29	51			0.28		0.12	1.0000						0.9735	N				1942.1	0	NO	
CHROMIUM	36	51			0.44		0.16	1.0000						1.0000	N				196.6	0	NO	
COBALT	31	51			0.39		0.35	1.0000						0.9999	N				375.2	0	NO	
COPPER	40	47			0.58		0.19	1.0000						1.0000	N				385.9	0	NO	
IRON	46	51			0.98		1.00	1.0000	1.0000			1.0000		1.0000	0.9900	N			1915387.0	0	NO	
LEAD	41	50			0.71		0.78	1.0000	1.0000			1.0000		0.9995	N				796.4	0	NO	
LITHIUM	31	51			0.55		1.00	1.0000						0.8200	N				125.0	0	NO	
MAGNESIUM	46	51			0.87		1.00	1.0000				0.0657		0.0655	0.0188	Y			35266.9	0	YES	
MANGANESE	47	51			0.87		1.00	1.0000				0.9756		0.3282	0.9898	N			18404.9	0	NO	
MERCURY	29	51			0.21		0.33	1.0000				0.5002		0.3482		N			1.1	0	NO	
MOLYBDENUM	29	51			0.31		0.75	1.0000						0.9538	N				197.2	0	NO	
NICKEL	31	51			0.42		0.47	1.0000						1.0000	N				476.0	0	NO	
POTASSIUM	37	51			0.54		1.00	1.0000						0.0002	Y				13719.0	0	YES	
SELENIUM	32	49			0.38		0.22	1.0000				0.0478		0.9575	N				16.6	0	NO	
SILICON	11	51			1.00		1.00	1.0000	1.0000					1.0000	N				23029.6	0	NO	
SILVER	28	47			0.36		0.06	1.0000						0.9996	N				107.1	0	NO	
SODIUM	48	51			0.98		1.00	0.0001				0.0001		0.0001	0.0001	Y			27145.6	30	YES	
STRONTIUM	37	51			0.70		1.00	1.0000						0.9900	N				2167.9	0	NO	
THALLIUM	35	51			0.11		0.00															NO HIT
TIN	31	51			0.42		0.20	1.0000						0.9996	N				794.7	0	NO	
VANADIUM	37	51			0.57		0.49	1.0000						1.0000	N				1096.5	0	NO	
ZINC	46	51			0.89		0.76	1.0000	1.0000					1.0000	N				1625.9	0	NO	

TABLE A-26

(1) No detect record from site

TABLE A-27
ROCKY FLATS OUG
Background Comparison t-Test Results of
Pond Surface Water Unfiltered Metals
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	ND	B	ND	S	MEAN	B	MEAN	S	STD	B	STD	S	F	CAL	F	TAB	DF	T	CAL	T	1	95	P	T	1	REMARK			
ALUMINUM	44	49			4	1	19493	4	259	2	49035	1	219	6	18	7	3	9	43	2	602	1	68	0	9937						NNDT more than 20%		
ANTIMONY	30	51	19	48			52	5	29	4	114	9	2	6																	NNDT more than 20%		
ARSENIC	40	51	14	30			76	3	4	7	200	5	0	8																	NNDT more than 20%		
BARIUM	40	51	7	0			993	7	47	5	1755	9	27	1	52	5	4	0	39	3	408	1	69	0	9992							NNDT more than 20%	
BERYLLIUM	34	51	21	49			3	2	2	4	3	4	0	4																	NNDT more than 20%		
CADMIUM	29	51	19	40			10	2	2	3	18	1	0	3																	NNDT more than 20%		
CALCIUM	48	51	0	0			101452	1	31122	5	133216	1	14175	5	22	2	3	9	48	3	638	1	68	0	9997							NNDT more than 20%	
CESIUM	29	51	21	45			445	9	447	3	430	8	14	59																		NNDT more than 20%	
CHROMIUM	36	51	20	43			26	1	4	7	51	4	0	6																		NNDT more than 20%	
COBALT	31	51	19	33			49	5	16	9	95	2	11	0																		NNDT more than 20%	
COPPER	40	47	17	38			47	9	10	7	104	0	3	7																		NNDT more than 20%	
IRON	46	51	1	0			193560	4	303	3	543454	4	250	3	22	7	3	9	45	2	412	1	68	0	9900							NNDT more than 20%	
LEAD	41	50	12	11			99	5	3	5	215	5	2	5																		NNDT more than 20%	
LITHIUM	31	51	14	0			35	2	19	1	26	2	15	5																		NNDT more than 20%	
MAGNESIUM	46	51	6	0			10943	0	14360	1	7677	2	8272	6	6	0	3	9	95	2	110	1	66	0	0188							NNDT more than 20%	
MANGANESE	47	51	6	0			1940	6	112	0	5215	5	84	5	23	2	3	9	46	-2	403	1	68	0	9898							NNDT more than 20%	
MERCURY	29	51	23	34			0	2	0	2	0	3	0	2																		NNDT more than 20%	
MOLYBDENUM	29	51	20	13			41	6	29	4	44	8	4	18																		NNDT more than 20%	
NICKEL	31	51	18	27			57	0	12	4	122	5	8	2																		NNDT more than 20%	
POTASSIUM	37	51	17	0			3764	9	6120	2	3018	7	2804	2																		NNDT more than 20%	
SELENIUM	32	49	20	38			3	7	2	9	3	8	1	0																		NNDT more than 20%	
SILICON	11	51	0	0			8408	2	2897	6	3027	8	1934	0																		NNDT more than 20%	
SILVER	28	47	18	44			11	5	4	8	27	3	0	6																		NNDT more than 20%	
SODIUM	48	51	1	0			12565	0	61372	5	4622	3	5389	1	2	60	4	3	9	51	6	443	1	68	0	0001							NNDT more than 20%
STRONTIUM	37	51	11	0			531	2	239	3	496	3	8	1																			NNDT more than 20%
THALLIUM	35	51	31	51			4	0	5	0	1	7	0	0																			NNDT more than 20%
TIN	31	51	18	41			108	9	82	1	200	4	36	6																			NNDT more than 20%
VANADIUM	37	51	16	26			128	9	14	6	293	4	10	8																			NNDT more than 20%
ZINC	46	51	5	12			209	4	15	6	447	1	12	2																			NNDT more than 20%

NNDT = Number of non detects

TABLE A-28
ROCKY FLATS OU6
Background Comparison Summary of
Pond Surface Water Filtered Metals
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	DTF B	DTF S	P	SLIP	P	QUAN	P	GEHAN	P	T	1	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
ALUMINIUM	42	48			0.26	0.67	1	10000				0.6986				N	1851	0	NO	
ANTIMONY	29	51			0.31	0.18	1	10000				0.9963				N	1239	0	NO	
ARSENIC	34	51			0.18	0.37	1	10000				0.1529				N	180	0	NO	
BARIUM	46	51			0.43	1.00	1	10000				1.0000				N	1886	0	NO	
BERYLLIUM	21	51			0.00	0.06	1	10000				0.5000				N	50	0	NO	
CADMIUM	26	51			0.00	0.10	1	10000				0.5000				N	50	0	NO	
CALCIUM	49	51			1.00	1.00	1	10000		1	0000	1.0000	0.9997			N	159463	0	NO	
CESIUM	30	51			0.13	0.18	1	10000				0.9959				N	2500	0	NO	
CHROMIUM	27	51			0.07	0.08	1	10000				0.8954				N	148	0	NO	
COBALT	30	51			0.07	0.33	1	10000				0.8347				N	500	0	NO	
COPPER	40	44			0.25	0.02	1	10000				0.8546				N	260	0	NO	
IRON	48	50			0.71	0.96	1	10000		1	0000	1.0000				N	149475	0	NO	
LEAD	41	50			0.22	0.46	0	5495				0.0143				Y	47	2	YES	
LITHIUM	42	51			0.33	1.00	1	10000				0.3195				N	962	0	NO	
MAGNESIUM	46	51			0.74	1.00	0	0721		0	0001	0.0001				Y	233998	14	YES	
MANGANESE	43	51			0.88	1.00	1	10000		0	9968	0.6805	0.9943			N	7286	0	NO	
MERCURY	22	51			0.27	0.22	1	10000				0.9575				N	44	0	NO	
MOLYBDENUM	33	51			0.21	0.69	1	10000				0.8586				N	2138	0	NO	
NICKEL	23	51			0.13	0.53	1	10000				0.9178				N	400	0	NO	
POTASSIUM	38	51			0.42	1.00	0	0001		0	0001	0.0001				Y	69114	28	YES	
SELENIUM	27	48			0.19	0.15	1	10000				0.8495				N	190	0	NO	NO BKGD measurement
SILICON	0	51				1.00														
SILVER	31	50			0.16	0.02	1	10000				0.8868				N	125	0	NO	
SODIUM	49	51			1.00	1.00	0	0001		0	0001	0.0001	0.0001			Y	297933	28	YES	
STRONTIUM	44	51			0.80	1.00	1	10000		1	0000	0.9745				N	17634	0	NO	
THALLIUM	26	51			0.04	0.00														NO HIT
TIN	35	51			0.17	0.16	1	10000				0.9964				N	2000	0	NO	
VANADIUM	37	51			0.16	0.45	1	10000				0.9821				N	500	0	NO	
ZINC	45	51			0.47	0.55	1	10000				0.8665				N	829	0	NO	

TABLE A-29
ROCKY FLAIFS OU6
Background Comparison Statistical Test Results of
Pond Surface Water Filtered Metals
(Slippage Test, Quantile Test Gehan Test, UTL Comparison)
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	ND	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UTL99	NGUTL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL
ALUMINUM	42	48	31	16	0.26	0.67	77.5	53.9	33.4	38.0	185.1	0	2000	154.0	0	1000	999	999	0000	0.520	1.645	0.6986																			
ANTIMONY	29	51	20	42	0.31	0.18	35.5	27.8	25.5	4.7	123.9	0	104.0	20.3	0	1000	999	999	0000	2.675	1.645	0.9963																			
ARSENIC	34	51	28	32	0.18	0.37	4.7	4.8	28	0.9	18.0	0	18.0	7.4	0	1000	999	999	0000	1.024	1.645	0.1529																			
BARUM	46	51	26	0	0.43	1.00	97.7	43.9	28.7	25.4	188.6	0	211.0	125.0	0	1000	999	999	0000	4.148	1.645	1.0000																			
BERYLLIUM	21	51	21	48	0.00	0.06	2.3	2.4	0.6	0.5	5.0	0	5.0	0.3	0	1000	999	999	0000	0.000	1.645	0.5000																			
CADMIUM	26	51	26	46	0.00	0.10	2.4	2.4	0.3	0.2	5.0	0	5.0	2.2	0	1000	999	999	0000	0.000	1.645	0.5000																			
CALCIUM	49	51	0	0	1.00	1.00	50869.4	31813.7	34547.7	14541.1	159463.0	0	2160000	86600.0	0	1000	20	3	10000	4.651	1.645	1.0000																			
CESIUM	30	51	26	42	0.13	0.18	7.0	42.3	70.1	166.6	2500.0	0	25000	120.0	0	1000	999	999	0000	2.646	1.645	0.9959																			
CHROMIUM	27	51	25	47	0.07	0.08	5.0	4.9	2.2	0.5	14.8	0	14.8	3.4	0	1000	999	999	0000	1.256	1.645	0.8954																			
COBALT	30	51	28	34	0.07	0.33	22.3	17.4	7.2	10.9	50.0	0	50.0	4.1	0	1000	999	999	0000	0.973	1.645	0.8347																			
COPPER	40	44	30	43	0.25	0.02	11.3	12.3	4.5	1.3	26.0	0	27.8	3.7	0	1000	999	999	0000	1.056	1.645	0.8546																			
IRON	48	50	14	2	0.71	0.96	1974.3	44.3	411.27	106.6	14947.5	0	167000	7650.0	0	1000	20	1	10000	6.083	1.645	1.0000																			
LEAD	41	50	32	27	0.22	0.46	2.1	2.2	0.8	1.1	4.7	2	5.4	6.5	1	0.550	999	999	0000	2.188	1.645	0.0143																			
LITHIUM	42	51	28	0	0.33	1.00	37.5	19.2	18.2	16.0	96.2	0	1000	57.3	0	1000	999	999	0000	0.469	1.645	0.3195																			
MAGNESIUM	46	51	12	0	0.74	1.00	7202.0	14718.8	5112.5	8523.8	23399.8	14	274000	295000.0	4	0.072	20	18	0.0001	4.608	1.645	0.0001																			
MANGANESE	43	51	5	0	0.88	1.00	130.8	53.3	186.5	55.8	728.6	0	7600	2620	0	1000	20	6	0.9968	0.469	1.645	0.6805																			
MERCURY	22	51	16	40	0.27	0.22	0.4	0.1	1.1	0.1	4.4	0	5.1	0.6	0	1000	999	999	0000	1.723	1.645	0.9575																			
MOLYBDENUM	33	51	26	16	0.21	0.69	77.6	35.3	40.4	44.3	213.8	0	2000	18.8	0	1000	999	999	0000	1.074	1.645	0.8586																			
NICKEL	23	51	20	24	0.13	0.53	17.6	12.1	5.0	8.4	40.0	0	40.0	30.3	0	1000	999	999	0000	1.390	1.645	0.9178																			
POTASSIUM	38	51	22	0	0.42	1.00	2442.4	6289.9	13623.3	2972.7	6911.4	28	70730	120000.0	28	0.000	18	18	0.0001	5.797	1.645	0.0001																			
SELENIUM	27	48	22	41	0.19	0.15	3.3	2.7	3.7	0.5	19.0	0	19.0	4.5	0	1000	999	999	0000	1.034	1.645	0.8495																			
SILICON(1)	0	51	0	0	1.00	1.00																																			
SILVER	31	50	26	49	0.16	0.02	4.8	5.0	1.8	0.3	12.5	0	12.5	3.2	0	1000	999	999	0000	1.210	1.645	0.8868																			
SODIUM	49	51	0	0	1.00	1.00	12466.2	63372.5	5512.4	55702.2	29793.3	28	352000	1920000.0	27	0.000	20	20	0.0001	8.354	1.645	0.0001																			
STRONTIUM	44	51	9	0	0.80	1.00	494.8	245.1	397.3	83.2	1763.4	0	10000	597.0	0	1000	19	1	10000	1.951	1.645	0.9745																			
THALLIUM(2)	26	51	25	51	0.04	0.00																																			
TIN	35	51	29	43	0.17	0.16	81.2	85.5	35.3	33.9	200.0	0	2000	11.8	0	1000	999	999	0000	2.690	1.645	0.9964																			
VANADIUM	37	51	31	28	0.16	0.45	20.1	15.3	8.9	10.8	50.0	0	50.0	4.8	0	1000	999	999	0000	2.099	1.645	0.9821																			
ZINC	45	51	24	23	0.47	0.55	17.4	12.1	20.6	5.9	82.9	0	1050	29.2	0	1000	999	999	0000	1.110	1.645	0.8665																			

(1) No background measurement
(2) No detect record from site

TABLE A-30
ROCKY FLATS OU6
Background Comparison t-Test Results of
Pond Surface Water Filtered Metals
(Concentration Unit UG/L)

ANALYTE	N	B	N	S	ND	B	ND	S	MEAN	B	MEAN	S	STD	B	STD	S	F	CAL	F	TAB	DF	T	CAL	T	1	95	P	T	I	REMARK	
ALUMINUM	42	48			31		16		77.5		53.9		33.4		38.0															NNDT more than 20%	
ANTIMONY	29	51			20		42		35.5		27.8		25.5		4.7															NNDT more than 20%	
ARSENIC	34	51			28		32		4.7		4.8		2.8		0.9																NNDT more than 20%
BARIUM	46	51			26		0		97.7		43.9		28.7		25.4															NNDT more than 20%	
BERYLLIUM	21	51			21		48		2.3		2.4		0.6		0.5																NNDT more than 20%
CADMIUM	26	51			26		46		2.4		2.4		0.3		0.2																NNDT more than 20%
CALCIUM	49	51			0		0		50869.4		31813.7		34547.7		14541.1		6.4		3.9	64	3.569	1.67									0.9997
CESIUM	30	51			26		42		750.0		423.7		701.0		166.6																NNDT more than 20%
CHROMIUM	27	51			25		47		5.0		4.9		2.2		0.5																NNDT more than 20%
COBALT	30	51			28		34		22.3		17.4		7.2		10.9																NNDT more than 20%
COPPER	40	44			30		43		11.3		12.3		4.5		1.3																NNDT more than 20%
IRON	48	50			14		2		1974.3		44.3		4112.7		106.6																NNDT more than 20%
LEAD	41	50			32		27		2.1		2.2		0.8		1.1																NNDT more than 20%
LITHIUM	42	51			28		0		37.5		19.2		18.2		16.0																NNDT more than 20%
MAGNESIUM	46	51			12		0		7202.0		14718.8		5112.5		8523.8																NNDT more than 20%
MANGANESE	43	51			5		0		130.8		53.3		186.5		55.8		31.7		3.9	48	2.629	1.68									0.9943
MERCURY	22	51			16		40		0.4		0.1		1.1		0.1																NNDT more than 20%
MOLYBDENUM	33	51			26		16		77.6		35.3		40.4		44.3																NNDT more than 20%
NICKEL	23	51			20		24		17.6		12.1		5.0		8.4																NNDT more than 20%
POTASSIUM	38	51			22		0		2442.4		6289.9		1362.3		2972.7																NNDT more than 20%
SELENIUM	27	48			22		41		3.3		2.7		3.7		0.5																NNDT more than 20%
SILICON	0	51			0		0				2939.5				1878.5																NO BKGD measurement
SILVER	31	50			26		49		4.8		5.0		1.8		0.3																NNDT more than 20%
SODIUM	49	51			0		0		12466.2		63372.5		5512.4		55702.2		60.1		3.9	51	6.494	1.68									0.0001
STRONTIUM	44	51			9		0		494.8		245.1		397.3		83.2																NNDT more than 20%
THALLIUM	26	51			25		51		5.3		5.0		3.2		0.0																NNDT more than 20%
TIN	35	51			29		43		81.2		85.5		35.3		33.9																NNDT more than 20%
VANADIUM	37	51			31		28		20.1		15.3		8.9		10.8																NNDT more than 20%
ZINC	45	51			24		23		17.4		12.1		20.6		5.9																NNDT more than 20%

NNDT = Number of non-detects

TABLE A-31
ROCKY FLATS OU6
Background Comparison Summary of
Pond Surface Water Unfiltered Radionuclides
(Concentration Unit pCi/L)

ANALYTE	N	B	N	S	DTI	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	1	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
AMERICIUM 241	37	49			1.00	1.00	1.00	1.00	1.00	1.00	0.5703	0.1674						N	0.080	0	NO	
CESIUM 137	37	18			1.00	1.00	1.00	1.00	1.00	1.00	1.0000	0.9796						N	7.157	0	NO	
GROSS ALPHA	36	48			1.00	1.00	1.00	1.00	1.00	1.00	1.0000	0.9284						N	340.129	0	NO	
GROSS BETA	10	51			1.00	1.00	1.00	1.00	1.00	1.00	0.0001	0.0001						Y	9.742	13	YES	
PLUTONIUM-239,240	33	51			1.00	1.00	1.00	1.00	1.00	1.00	0.9825	0.9268						N	2.849	0	NO	
RADIUM-226	12	0			0.00	0.00	0.00	0.00	0.00	0.00												NO site measurement
RADIUM-228	5	0			0.00	0.00	0.00	0.00	0.00	0.00												NO site measurement
STRONTIUM-89,90	32	51			1.00	1.00	1.00	1.00	1.00	0.2267	0.4931	0.1420						N	1.614	0	NO	
TRITIUM	31	46			1.00	1.00	1.00	1.00	1.00	1.00	0.5178	0.4917						N	4277.820	0	NO	
URANIUM TOTAL	0	0			0.00	0.00	0.00	0.00	0.00	0.00												NO measurements
URANIUM-233,234	33	51			1.00	1.00	1.00	1.00	1.00	1.00	0.0352	0.0001						Y	4.988	0	YES	
URANIUM-235	32	51			1.00	1.00	1.00	1.00	1.00	0.0161	0.0266	0.0032						Y	0.307	4	YES	
URANIUM-238	28	51			1.00	1.00	1.00	1.00	1.00	1.00	0.0995	0.0008						Y	4.885	0	YES	

TABLE A-32
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
Pond Surface Water Unfiltered Radionuclides
(Shippage Test Quantile Test Gehan Test, UTL Comparison)
(Concentration Unit pCi/l)

ANALYTE	N	B	N	S	ND	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UTL99	NGUTL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL				
AMERICIUM 241	37	49	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.013	0.010	0.033	0.010	0.020	0.010	0.080	0	0.100	0.038	0	1.0000	0	1.0000	19	11	0.5703	0.964	1.645	0.1674													
CESIUM 137	37	18	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.584	0.033	1.993	0.295	7.157	0	12.000	0.331	0	1.0000	0.331	0	1.0000	12	0	1.0000	2.045	1.645	0.9796														
GROSS ALPHA	36	48	0	0	0	0	0	0	1.00	1.00	1.00	1.00	42.517	3.078	89.767	1.634	340.129	0	440.000	7.879	0	1.0000	7.879	0	1.0000	17	2	1.0000	1.464	1.645	0.9284														
GROSS BETA	10	51	0	0	0	0	0	0	1.00	1.00	1.00	1.00	2.149	7.715	1.496	3.038	9.742	13	4.300	15.000	44	0.0001	44	0.0001	13	13	0.0725	4.784	1.645	0.0001															
PLUTONIUM 239_40	33	51	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.214	0.015	0.781	0.019	2.849	0	4.400	0.076	0	1.0000	0.076	0	1.0000	17	1	0.9825	1.452	1.645	0.9268														
RADIUM 226(1)	12	0	0	0	0	0	0	0																																					
RADIUM 228(1)	5	0	0	0	0	0	0	0																																					
STRONTIUM 89_90	32	51	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.317	0.412	0.382	0.376	1.614	0	1.100	1.541	3	0.2267	3	0.2267	17	11	0.4331	1.071	1.645	0.1420															
TRITIUM	31	46	0	0	0	0	0	0	1.00	1.00	1.00	1.00	87.722	126.463	1275.950	134.620	4277.820	0	475.000	430.000	0	1.0000	0	1.0000	16	10	0.5178	0.021	1.645	0.4917															
URANIUM TOTAL(2)	0	0	0	0	0	0	0	0																																					
URANIUM 233_234	33	51	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.637	1.244	1.289	1.040	4.988	0	6.900	3.688	0	1.0000	0	1.0000	17	14	0.0352	3.907	1.645	0.0001															
URANIUM 235	32	51	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.022	0.104	0.084	0.120	0.307	4	0.190	0.560	8	0.0161	8	0.0161	18	15	0.0266	2.723	1.645	0.0032															
URANIUM 238	28	51	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.642	1.393	1.212	1.395	4.885	0	5.930	4.475	0	1.0000	0	1.0000	16	13	0.0995	3.147	1.645	0.0008															

(1) No site measurement

(2) No background measurement

TABLE A-33
ROCKY FLATS OU6
Background Comparison Summary of
Pond Surface Water Filtered Radionuclides
(Concentration Unit pCi/L)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	1	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
AMERICIUM 241	8			51	100	100	100	1000	0.9904	0.8733								N	1 755	0	NO	
CESIUM 137	3			18	100	100	100	0.0075	0.4211	0.0104								Y	4 708	0	YES(1)	
GROSS ALPHA	13			0	000	000	000															NO site measurement
GROSS BETA	14			0	000	000	000															NO site measurement
PLUTONIUM 239 240	8			51	100	100	100	10000	0.9539	0.9662								N	1 016	0	NO	
RADIUM 226	2			0	000	000	000															NO site measurement
RADIUM 228	1			0	000	000	000															NO site measurement
STRONTIUM 89 90	20			49	100	100	100	0.1697	0.9761	0.9430								N	2 013	1	YES	
TRITIUM	13			0	000	000	000															NO site measurement
URANIUM TOTAL	0			0	000	000	000															NO measurements
URANIUM 233 234	13			49	100	100	100	0.1013	0.1760	0.0640								N	4 192	0	NO	
URANIUM 235	12			49	100	100	100	0.8033	0.9861	0.8972								N	0 716	0	NO	
URANIUM 238	13			48	100	100	100	0.0155	0.0294	0.0091								Y	3 032	7	YES	

(1) Sample size is too small

TABLE A-34
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
Pond Surface Water Filtered Radionuclides
(Shippage Test, Quantile Test, Gehan Test, UTL Comparison)
(Concentration Unit pCi/L)

ANALYTI	N	B	N	S	ND	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UTL99	NGUTL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL
AMERICIUM 241	8	51	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.128	0.007	0.280	0.013	1.755	0	0.800	0.077	0	1.0000	13	9	0.9904	1.142	1.645	0.8733													
CESIUM 137	3	18	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.267	0.183	0.208	0.263	4.708	0	0.100	0.610	16	0.0075	5	5	0.4211	2.312	1.645	0.0104													
GROSS ALPHA(1)	13	0	0	0	0	0	0	0																																	
GROSS BETA(1)	14	0	0	0	0	0	0	0																																	
PLUTONIUM 239 240	8	51	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.099	0.016	0.158	0.024	1.016	0	0.400	0.100	0	1.0000	12	9	0.9539	1.828	1.645	0.9662													
RADIUM 226(1)	2	0	0	0	0	0	0	0																																	
RADIUM 228(1)	1	0	0	0	0	0	0	0																																	
STRONTIUM 89 90	20	49	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.515	0.406	0.391	0.470	2.013	1	1.000	2.502	5	0.1697	15	8	0.9761	1.581	1.645	0.9430													
TRITIUM(1)	13	0	0	0	0	0	0	0																																	
URANIUM TOTAL(2)	0	0	0	0	0	0	0	0																																	
URANIUM 233 234	13	49	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.906	1.378	0.735	0.995	4.192	0	2.600	3.391	9	0.1013	13	12	0.1760	1.522	1.645	0.0640													
URANIUM 235	12	49	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.124	0.066	0.128	0.079	0.716	0	0.300	0.370	1	0.8033	13	8	0.9861	1.266	1.645	0.8972													
URANIUM 238	13	48	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.605	1.401	0.543	1.205	3.032	7	1.700	4.310	15	0.0155	13	13	0.0294	2.360	1.645	0.0091													

(1) No site measurement

(2) No background measurement

TABLE A-35
ROCKY FLATS OU6
Background Comparison Summary of
Stream Sediment Metals
(Concentration Unit MG/KG)

ANALYTE	N	B	N	S	DTT	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	I	SIGNIFIC	UTL99	NGUTL	PCOC	REMARK
ALUMINUM	59	15			1.00	1.00	1.00	1.00	1.00	1.00	0.6358	0.0705						N	20880.1	0	NO	
ANTIMONY	52	15			0.17	0.13	1.00	1.00	1.00	1.00		0.4121						N	60.0	0	NO	
ARSENIC	59	15			0.49	0.93	1.00	1.00	1.00	1.00		0.0007						Y	101	0	YES	
BARIUM	57	15			1.00	1.00	1.00	1.00	1.00	1.00	0.8810	0.0197						Y	250.8	0	YES	
BERYLLIUM	57	15			0.53	0.53	1.00	1.00	1.00	1.00		0.5367						N	11.6	0	NO	
CADMIUM	51	15			0.29	0.07	1.00	1.00	1.00	1.00		0.9908						N	3.5	0	NO	
CALCIUM	59	15			1.00	1.00	1.00	1.00	1.00	1.00	0.0092	0.0001						Y	17888.3	1	YES	
CESIUM	56	15			0.86	0.47	1.00	1.00	1.00	1.00	1.00	0.9998						N	513.5	0	NO	
CHROMIUM	59	15			0.83	1.00	1.00	1.00	1.00	1.00	0.8947	0.4866						N	31.1	0	NO	
COBALT	59	15			0.88	1.00	1.00	1.00	1.00	1.00		0.0021						Y	19.3	0	YES	
COPPER	59	15			0.80	0.60	1.00	1.00	1.00	1.00	0.6871	0.7164						N	36.0	0	NO	
IRON	59	15			1.00	1.00	1.00	1.00	1.00	1.00	0.1471	0.0001						Y	27966.4	0	YES	
LEAD	59	15			1.00	1.00	1.00	1.00	1.00	1.00	0.6358	0.0602						N	134.3	0	NO	
LITHIUM	57	15			0.91	0.93	1.00	1.00	1.00	1.00		0.7018						N	41.3	0	NO	
MAGNESIUM	59	15			1.00	1.00	1.00	1.00	1.00	1.00	0.0436	0.0014						Y	5262.0	0	YES	
MANGANESE	59	15			0.80	1.00	1.00	1.00	1.00	1.00	0.0436	0.0024						Y	905.0	1	YES	
MERCURY	49	15			0.86	0.27	1.00	1.00	1.00	1.00		1.0000						N	0.5	0	NO	NO site measurement
MOLYBDENUM	0	0			0.00	0.00	0.00	0.00	0.00	0.00												
NICKEL	57	15			0.88	0.47	1.00	1.00	1.00	1.00		0.3626						N	24.2	0	NO	
POTASSIUM	58	15			1.00	0.93	1.00	1.00	1.00	1.00	0.0100	0.0002						Y	3112.5	0	YES	
SELENIUM	58	15			0.40	0.13	1.00	1.00	1.00	1.00		0.8914						N	3.5	0	NO	
SILICON	0	0			0.00	0.00	0.00	0.00	0.00	0.00												NO site measurement
SILVER	54	15			0.48	0.07	1.00	1.00	1.00	1.00		0.9170						N	12.0	0	NO	
SODIUM	59	15			0.69	0.87	1.00	1.00	1.00	1.00		0.0806						N	1745.1	0	NO	
STRONTIUM	58	15			0.88	1.00	1.00	1.00	1.00	1.00		0.0079						Y	294.8	0	YES	
THALLIUM	50	15			0.40	0.33	1.00	1.00	1.00	1.00		0.8391						N	2.3	0	NO	
TIN	0	0			0.00	0.00	0.00	0.00	0.00	0.00												NO site measurement
VANADIUM	57	15			0.70	1.00	1.00	1.00	1.00	1.00		0.0128						Y	63.4	0	YES	
ZINC	59	15			0.95	1.00	1.00	1.00	1.00	1.00	0.0144	0.0005						Y	307.8	0	YES	

TABLE A-36
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
Stream Sediment Metals
(Slippage Test, Quantile Test, Gehan Test, UTL Comparison)
(Concentration Unit MG/KG)

ANALYTE	N	B	N	S	ND	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	SFD	S	UTL99	NGUTL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SIFL	P	QUAN	Z	CAL	Z	95	P	VAL
ALUMINUM	59	15	0	0	0	0	0	0	1.00	0	1.00	1.00	5887.6	6922.3	4912.7	2881.1	20880.1	0	25200.0	11600.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	15	3	0.6358	1.472	1.645	0.0705					
ANTIMONY	52	15	43	13	0	0	0	0	0.13	0	0.13	0.13	7.4	8.1	7.9	5.9	60.0	0	60.0	26.3	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	0.222	1.645	0.4121					
ARSENIC	59	15	30	1	0	0	0	0	0.93	0	0.93	0.93	2.4	3.6	2.5	1.3	10.1	0	17.3	5.8	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	3.198	1.645	0.0007					
BARIUM	57	15	0	0	0	0	0	0	1.00	0	1.00	1.00	77.9	106.6	56.4	32.5	250.8	0	244.0	177.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	15	2	0.8810	2.059	1.645	0.0197					
BERYLLIUM	57	15	27	7	0	0	0	0	0.53	0	0.53	0.53	1.2	0.6	3.4	0.2	11.6	0	26.0	1.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	0.092	1.645	0.5367					
CADMIUM	51	15	36	14	0	0	0	0	0.07	0	0.07	0.07	0.9	0.5	0.8	0.1	3.5	0	5.0	0.8	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	2.359	1.645	0.9908					
CALCIUM	59	15	0	0	0	0	0	0	1.00	0	1.00	1.00	3659.8	13263.7	4662.4	21046.1	17888.3	1	17100.0	95700.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	15	7	0.0092	4.054	1.645	0.0001					
CESIUM	56	15	8	8	0	0	0	0	0.47	0	0.47	0.47	139.9	60.3	121.4	43.9	513.5	0	621.0	18.1	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	15	0	1.0000	3.499	1.645	0.9998					
CHROMIUM	59	15	10	0	0	0	0	0	0.83	0	0.83	1.00	8.3	6.9	7.5	3.5	31.1	0	29.7	12.3	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	16	2	0.8947	0.034	1.645	0.4866					
COBALT	59	15	7	0	0	0	0	0	0.88	0	0.88	1.00	6.5	8.2	4.2	2.0	19.3	0	50.0	12.4	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	2.859	1.645	0.0021					
COPPER	59	15	12	6	0	0	0	0	0.80	0	0.80	0.60	11.0	9.5	8.2	6.6	36.0	0	36.7	17.7	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	16	3	0.6871	0.572	1.645	0.7164					
IRON	59	15	0	0	0	0	0	0	1.00	0	1.00	1.00	8852.6	13810.0	6263.2	3237.4	27966.4	0	31400.0	21500.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	15	5	0.1471	3.812	1.645	0.0001					
LEAD	59	15	0	0	0	0	0	0	1.00	0	1.00	1.00	22.0	20.9	36.8	21.8	134.3	0	244.0	94.8	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	15	3	0.6358	1.553	1.645	0.0602					
LITHIUM	57	15	5	1	0	0	0	0	0.93	0	0.93	0.93	11.0	7.0	9.9	3.0	41.3	0	45.8	15.2	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	0.529	1.645	0.7018					
MAGNESIUM	59	15	0	0	0	0	0	0	1.00	0	1.00	1.00	1494.7	2317.0	1234.5	848.3	5262.0	0	5850.0	3580.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	15	6	0.0436	2.978	1.645	0.0014					
MANGANESE	59	15	12	0	0	0	0	0	0.80	0	0.80	1.00	216.9	366.5	225.5	240.4	905.0	1	1280.0	1000.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	15	6	0.0436	2.816	1.645	0.0024					
MERCURY	49	15	7	11	0	0	0	0	0.86	0	0.86	0.27	0.1	0.1	0.1	0.0	0.5	0	0.6	0.1	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	4.175	1.645	1.0000					
MOLYBDENUM(1)																																									
NICKEL	57	15	7	8	0	0	0	0	0.88	0	0.88	0.47	8.1	8.3	5.3	5.4	24.2	0	40.0	19.2	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	0.352	1.645	0.3626					
POTASSIUM	58	15	0	1	0	0	0	0	1.00	0	1.00	0.93	909.7	1492.4	720.0	559.1	3112.5	0	3770.0	2660.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	15	7	0.0100	3.489	1.645	0.0002					
SELENIUM	58	15	35	13	0	0	0	0	0.13	0	0.13	0.13	0.9	0.5	0.8	0.0	3.5	0	5.0	0.5	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	-1.234	1.645	0.8914					
SILICON(1)																																									
SILVER	54	15	28	14	0	0	0	0	0.48	0	0.48	0.07	2.3	1.0	3.1	0.1	12.0	0	25.0	1.4	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	1.385	1.645	0.9170					
SODIUM	59	15	18	2	0	0	0	0	0.69	0	0.69	0.87	303.9	258.0	472.3	135.4	1745.1	0	5000.0	483.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	1.401	1.645	0.0806					
STRONTIUM	58	15	7	0	0	0	0	0	0.88	0	0.88	1.00	50.8	48.7	79.8	25.1	294.8	0	421.0	95.8	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	2.412	1.645	0.0079					
THALLIUM	50	15	30	10	0	0	0	0	0.40	0	0.40	0.33	0.7	0.8	0.5	0.3	2.3	0	2.6	0.5	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	0.991	1.645	0.8391					
TIN(1)																																									
VANADIUM	57	15	17	0	0	0	0	0	0.70	0	0.70	1.00	18.7	23.4	14.6	6.7	63.4	0	73.0	33.9	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	999	999	0.0000	2.232	1.645	0.0128					
ZINC	59	15	3	0	0	0	0	0	0.95	0	0.95	1.00	54.3	75.3	83.0	35.9	307.8	0	639.0	178.0	0	1.0000	0	1.0000	0	1.0000	0	1.0000	0	1.0000	16	7	0.0144	3.268	1.645	0.0005					

(1) No site measurement

TABLE A-37
ROCKY FLATS OU6
Background Comparison Summary of
Stream Sediment Radionuclides
(Concentration Unit pCi/G)

ANALYTE	N	B	N	S	DTF	B	DTF	S	P	SLIP	P	QUAN	P	GEHAN	P	T	I	SIGNIFICT	UTL99	NGUTL	PCOC	REMARK
AMERICIUM 241	37	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.3923	0.0031	0.0031	Y	1.770	0	YES	0	YES			
CESIUM 137	35	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.9821	0.5551	0.5551	N	1.541	0	NO	0	NO			
GROSS ALPHA	45	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0000	0.6776	0.6776	N	88.058	0	NO	0	NO			
GROSS BETA	43	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0000	1.0000	1.0000	N	67.337	0	NO	0	NO			
PLUTONIUM 239,240	45	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.0355	0.0059	0.0059	Y	5.658	0	YES	0	YES			
RADIUM 226	21	1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0000	0.3466	0.3466	N	2.216	0	NO(1)	0	NO(1)			
RADIUM 228	20	1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0000	0.4344	0.4344	N	4.547	0	NO(1)	0	NO(1)			
STRONTIUM 89,90	43	8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.5572	0.6464	0.6464	N	1.087	0	NO	0	NO			
TRITIUM(2)	42	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.2632	0.0460	0.5576	0.5576	Y	1047.685	1	YES	1	YES			NO site measurement
URANIUM TOTAL	0	0																				
URANIUM-233,234	47	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0000	0.9942	0.9942	N	5.293	0	NO	0	NO			
URANIUM 235	49	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0000	0.9351	0.9351	N	0.212	0	NO	0	NO			
URANIUM 238	36	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0000	0.9530	0.9530	N	4.817	0	NO	0	NO			

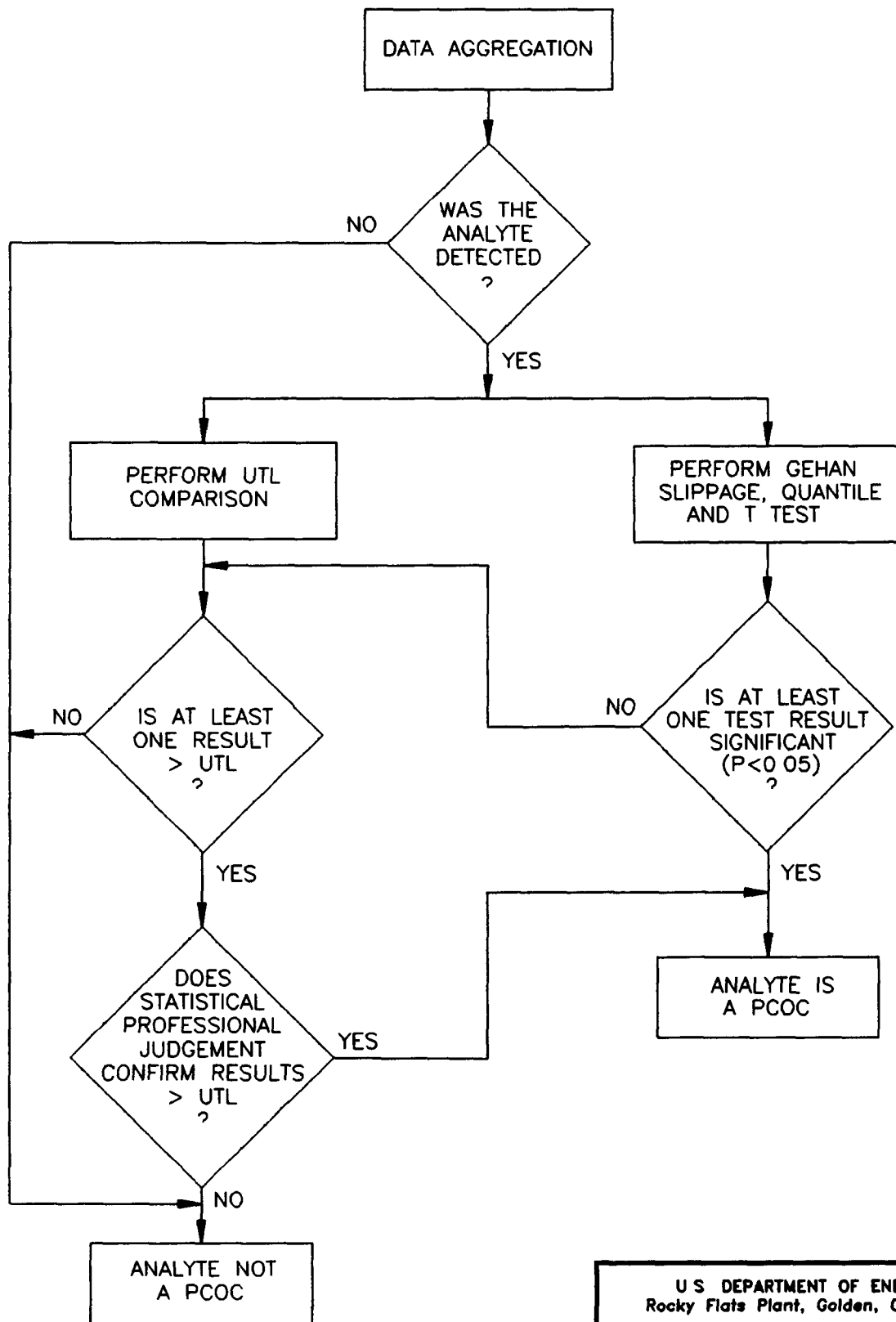
(1) Sample size is too small

(2) Concentration Unit pCi/L

TABLE A-38
ROCKY FLATS OU6
Background Comparison Statistical Test Results of
Stream Sediment Radionuclides
(Slippage Test, Quantile Test Gehan Test UTL Comparison)
(Concentration Unit pCi/G)

ANALYTE	N	B	S	N	D	B	ND	S	DTF	B	DTF	S	MEAN	B	MEAN	S	STD	B	STD	S	UT199	NGUTL	MAX	B	MAX	S	NGM	P	SLP	N	T20	N	SITE	P	QUAN	Z	CAL	Z	95	P	VAL
AMERICIUM 241	37	15	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.173	0.125	0.484	0.200	0.1770	0	2.526	0.75	0	1.0000	11	4	0.3923	2.738	1.645	0.0031													
CESTIUM 137	35	15	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.262	0.141	0.383	0.107	1.541	0	1.500	0.44	0	1.0000	10	1	0.9821	0.138	1.645	0.5551													
GROSS ALPHA	45	15	0	0	0	0	0	0	1.00	1.00	1.00	1.00	22.976	13.065	20.463	3.446	88.058	0	72.000	18.00	0	1.0000	12	0	1.0000	0.461	1.645	0.6776													
GROSS BETA	43	15	0	0	0	0	0	0	1.00	1.00	1.00	1.00	35.349	24.608	9.978	2.202	67.337	0	59.000	27.80	0	1.0000	12	0	1.0000	-4.271	1.645	1.0000													
PLUTONIUM 239 240	45	15	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.537	0.287	1.610	0.509	5.658	0	8.933	1.95	0	1.0000	12	6	0.0355	2.519	1.645	0.0059													
RADIUM 226	21	1	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.849	0.930	0.362	2.216	0	1.800	0.93	0	1.0000	5	0	1.0000	0.395	1.645	0.3466														
RADIUM 228	20	1	0	0	0	0	0	0	1.00	1.00	1.00	1.00	1.701	1.600	0.743	4.547	0	3.453	1.60	0	1.0000	5	0	1.0000	0.165	1.645	0.4344														
STRONTIUM 89 90	43	8	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.206	0.190	0.275	0.171	1.087	0	1.165	0.49	0	1.0000	11	2	0.5572	0.376	1.645	0.6464													
TRITIUM (1)	42	15	0	0	0	0	0	0	1.00	1.00	1.00	1.00	194.297	977.603	265.068	2844.995	1047.685	1	1770.000	11200.00	1	0.2632	12	6	0.0460	0.145	1.645	0.5576													
URANIUM TOTAL(2)	0	0	0	0	0	0	0	0																																	
URANIUM 233 234	47	15	0	0	0	0	0	0	1.00	1.00	1.00	1.00	1.677	0.904	1.145	0.301	5.293	0	4.500	1.64	0	1.0000	13	0	1.0000	2.523	1.645	0.9942													
URANIUM 235	49	15	0	0	0	0	0	0	1.00	1.00	1.00	1.00	0.062	0.040	0.048	0.026	0.212	0	0.191	0.08	0	1.0000	13	0	1.0000	1.515	1.645	0.9351													
URANIUM 238	36	15	0	0	0	0	0	0	1.00	1.00	1.00	1.00	1.399	0.868	1.031	0.260	4.817	0	3.820	1.42	0	1.0000	11	0	1.0000	1.675	1.645	0.9530													

(1) Concentration Unit pCi/l
(2) No background measurement



UTL UPPER TOLERANCE LIMIT
OF BACKGROUND DATA (99/99)

PCOC POTENTIAL CHEMICAL OF
CONCERN

U S DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

BACKGROUND COMPARISON
PROCESS

FIGURE A-1

JULY 1994

QJSTMA1

APPENDIX B

RISK-BASED EVALUATION OF INFREQUENTLY DETECTED CHEMICALS

B.1 PURPOSE AND APPROACH

The chemicals of concern evaluated in a quantitative human health risk assessment are the subset of all site-related chemicals that are thought to pose the greatest potential risk to human health. The determination that these chemicals may pose the greatest potential risk is generally based on an evaluation of the following three criteria:

- The inherent toxicity of the chemical
- The concentrations of the chemical found on-site and
- The potential for human exposure to the chemical (e.g., whether or not the chemical is widely distributed across the site or could readily migrate from the site)

In general, compounds found at low frequency (<5% of all samples for a particular media) are not included as chemicals of concern because the potential for human exposure is limited. However, all infrequently detected compounds were evaluated according to the procedures shown in Figure 2-1 so as not to neglect infrequently detected chemicals that could contribute significantly to risk if they were co-located with other potentially hazardous compounds at source areas or locations where routine exposure could occur.

This evaluation examines those metals (detected above background) and organic chemicals that were initially excluded from the chemicals of concern based on low frequency of detection, using a health-based screening approach. A screening evaluation was performed using risk-based concentrations (RBCs) calculated in guidance provided by DOE (1994). The screening evaluation was performed for all low-frequency chemicals for which RBCs were available. As a benchmark, it was assumed that any infrequently detected chemical whose maximum concentration was greater than 1000 times the RBC warrants further evaluation. The purpose is to identify those infrequently detected chemicals that may pose an

unacceptable health risk (cancer or non-cancer) if chronic exposure were to occur. These chemicals are retained for separate evaluation in the risk assessment. Since they are not characteristic of contamination in OU6, risk will be assessed separately at the locations where the special case chemicals are found.

RBCs for surface soil were calculated assuming a residential exposure scenario, using standard toxicity values (RfDs and SFs) established by EPA, and using the exposure assumptions outlined below (DOE 1994). For surface soils, pond sediments, and stream sediments, multiple pathway exposure was assumed (ingestion and inhalation of particulates) in calculating RBCs. The RBC for residential soil (surface soil) is used for surface soil, pond sediment, and stream sediment in this evaluation. For carcinogenic effects the target excess lifetime cancer risk is assumed to be 10^{-6} (1 in 1,000,000), the exposure frequency is 350 days/year, exposure duration is 30 years, averaging time is 70 years, daily inhalation rate is $20 \text{ m}^3/\text{day}$, the particulate emission factor (for non-volatile organics and inorganics) is $4.63 \times 10^9 \text{ m}^3/\text{kg}$, body weight is 70 kg, and the age-adjusted soil ingestion factor is 114 mg-yr/kg-day . All exposure parameters are EPA standard default exposures for adult residents, except for soil ingestion, which is a time-weighted average for child and adult exposures. For noncarcinogenic effects, all of the exposure parameters are the same as the carcinogenic exposure parameters except the averaging time is 30 years and instead of a target excess lifetime cancer risk, the target hazard index is 1.

RBCs for subsurface soil were calculated assuming a construction worker exposure scenario, using standard toxicity factors and the exposure assumptions outlined below (DOE 1994). Multiple pathway exposure, including ingestion of soil and inhalation of particulates and VOCs, were used to calculate RBCs. The carcinogenic RBC for construction worker exposures to subsurface soil assumes the following: the target excess lifetime cancer risk is 10^{-6} (1 in 1,000,000), the exposure frequency is 30 days/year, exposure duration is 1 year, averaging time is 70 years, daily inhalation rate is $6.64 \text{ m}^3/\text{day}$, the particulate emission factor is $4.63 \times 10^9 \text{ m}^3/\text{kg}$, body weight is 70 kg, the soil ingestion factor is 50 mg/day and the soil-to-air volatilization factor is chemical-specific. All exposure parameters are EPA standard default exposures for construction workers. For noncarcinogenic effects, all of the exposure parameters are the same as the carcinogenic exposure parameters except the averaging time is 30 years and instead of a target excess lifetime cancer risk, the target hazard index is 1.

The RBCs for groundwater assume a residential scenario including ingestion and inhalation of volatile organic chemicals released during use. The residential groundwater RBCs are also used in the evaluation of pond surface water, even though surface water is not expected to be used for domestic drinking water. The RBCs for residential groundwater are more conservative than the RBCs for residential surface water (based on swimming exposures), therefore providing more stringent screening criteria for chemicals found in pond surface water. The exposure parameters for groundwater are: target excess lifetime cancer risk of 10^{-6} (1 in 1,000,000), body weight of 70 kg, averaging time of 70 years, exposure frequency of 350 days/yr, exposure duration of 30 years, daily indoor inhalation rate of 15 m³/day, a volatilization factor (for volatile organic chemicals) of 0.5 L/m³, and a daily ingestion rate of 2 L/day. All exposures are EPA standard default exposures for adult residents. For noncarcinogenic effects, all of the exposure parameters are the same as the carcinogenic exposure parameters except the averaging time is 30 years and instead of a target excess lifetime cancer risk, the target hazard index is 1.

B.2 SURFACE SOIL

One metal (molybdenum) and one PCB (Aroclor-1254) were detected at low frequency (<5% detection) in surface soil samples. Table B-1 presents a comparison of the maximum detected concentrations to the health-based screening criteria (both cancer and non-cancer). Chemicals whose maximum detected concentration were greater than 1000 times either the cancer or non-cancer RBCs will be retained for further evaluation as special case chemicals of concern. Table B-1 shows that neither molybdenum nor Aroclor-1254 had concentrations above 1000 times the RBC, and therefore they will not require further evaluation in the risk assessment.

B.3 SUBSURFACE SOIL

Twelve VOCs and SVOCs were reported at less than 5 percent frequency in subsurface soils. These are listed in Table B-2. None of the twelve chemicals exceeded the 1000 times the RBC, and therefore they will not require further evaluation in the risk assessment.

B.4 GROUNDWATER

Table B-3 lists 13 organic chemicals detected at less than 5 percent frequency in groundwater. Of these, two (1,2,4-trimethylbenzene and 2-hexanone) do not have RBCs. Table B-6 shows the two additional chemicals detected at low frequency in all media for which there are no RBCs. Vinyl chloride was the only chemical detected at concentrations exceeding the screening level criteria and it will require further evaluation in the risk assessment.

B.5 POND SEDIMENT

Twelve VOCs, SVOCs, pesticides and PCBs were detected at less than 5 percent frequency in pond sediments. Dibenzofuran and 2-methylnaphthalene were detected at low frequency, but do not have RBCs and are listed on Table B-6. The remaining ten chemicals are listed on Table B-4. None of the 10 chemicals were detected at concentrations exceeding 1000 times the RBC, and they will not require further evaluation in the risk assessment.

B.6 POND SURFACE WATER

Table B-5 lists the two chemicals (1,2-dichloroethane and tetrachloroethene) detected at low frequency in pond surface water. Neither chemical exceeded the screening-level criteria, and they will not require further evaluation in the risk assessment.

B.7 STREAM SEDIMENT

No chemicals were detected at low frequency in stream sediments, therefore, a screening-level evaluation was not performed.

References

Department of Energy (DOE) 1994 Programmatic Preliminary Remediation Goals Draft
Final Rocky Flats Plant Golden, CO June 1994

TABLE B-1
ROCKY FLATS OU6
INFREQUENTLY DETECTED COMPOUNDS
COMPARISON TO RBCs
SURFACE SOIL

Chemical	Maximum Detected Conc (mg/kg)	Residential Soil RBC (mg/kg)	Max Conc > RBC?	Max Conc > 1000 x RBC?
Organic Compounds				
Aroclor-1254	0.425	8.32E-02	YES	NO
Metals				
Molybdenum	9.9	1.37E+03	NO	NO

TABLE B-2
ROCKY FLATS OU6
INFREQUENTLY DETECTED COMPOUNDS
COMPARISON TO RBCs
SUBSURFACE SOIL⁽¹⁾

Chemical	Maximum Detected Conc (mg/kg)	Construction Worker RBC (mg/kg)	Max Conc > RBC?	Max Conc > 1000 x RBC?
Organic Compounds				
1,4-Dichlorobenzene	0.064	4.97E+04	NO	NO
4-Methyl-2-pentanone	0.004	8.52E+05	NO	NO
Acenaphthene	0.056	1.02E+06	NO	NO
Benzene	0.006	3.27E+00	NO	NO
Benzo(a)anthracene	0.099	1.63E+03	NO	NO
Benzo(k)fluoranthene	0.06	1.63E+03	NO	NO
Chlorobenzene	0.074	2.11E+01	NO	NO
Chloroform	0.002	1.70E+05	NO	NO
Chrysene	0.12	1.63E+05	NO	NO
Diethyl phthalate	0.3	1.36E+07	NO	NO
Di-n-octyl phthalate	0.072	3.41E+05	NO	NO
Indeno(1,2,3-cd)pyrene	0.099	1.63E+03	NO	NO
Pentachlorophenol	0.66	9.93E+03	NO	NO
Phenol	0.055	1.02E+07	NO	NO
Styrene	0.001	3.41E+06	NO	NO
Trichloroethene	0.021	1.08E+05	NO	NO
Xylenes, total	0.002	3.41E+07	NO	NO

⁽¹⁾ Excluding Old Outfall (IHSS 143)

TABLE B-3
ROCKY FLATS OU6
INFREQUENTLY DETECTED COMPOUNDS
COMPARISON TO RBCs
UHSU GROUNDWATER

Chemical	Maximum Detected Conc (mg/l)	Residential Groundwater RBC (mg/l)	Max Conc > RBC?	Max Conc > 1000 x RBC?
Organic Compounds				
1,1-Dichloroethene	0 005	1 67E-05	YES	NO
1,2-Dichloroethane	0 002	1 97E-04	YES	NO
1,2-Dichloroethene, trans ⁽¹⁾	0 009	3 28E-01	NO	NO
2-Butanone	0 001	2 47E+00	NO	NO
4-Methyl-2-pentanone	0 002	1 98E-01	NO	NO
Benzene	0 003	6 15E-04	YES	NO
Carbon disulfide	0 004	2 76E-02	NO	NO
Carbon tetrachloride	0 008	2 60E-04	YES	NO
Chloromethane	0 00025	2 32E-03	NO	NO
Ethylbenzene	0 001	1 58E+00	NO	NO
Styrene	0 00011	2 01E+00	NO	NO
Vinyl chloride	0 86	2 81E-05	YES	YES
Xylenes (total)	0 014	7 30E+01	NO	NO

⁽¹⁾ The RBC for 1,2-Dichloroethene, total was used

TABLE B-4
ROCKY FLATS OU6
INFREQUENTLY DETECTED COMPOUNDS
COMPARISON TO RBCs
POND SEDIMENT

Chemical	Maximum Detected Conc (mg/kg)	Residential Soil RBC (mg/kg)	Max Conc > RBC?	Max Conc > 1000 x RBC?
Organic Compounds				
1,2,4-Trichlorobenzene	0.13	2.74E+03	NO	NO
4-Methyl-2-pentanone	0.006	1.37E+04	NO	NO
Aldrin	0.054	3.77E-02	YES	NO
Aroclor-1260	0.86	8.32E-02	YES	NO
Dibenzo(a,h)anthracene	0.15	8.77E-02	YES	NO
Fluorene	0.46	1.10E+04	NO	NO
gamma-BHC (Lindane)	0.025	4.93E-01	NO	NO
Heptachlor	0.039	1.42E-01	NO	NO
Naphthalene	0.39	1.10E+04	NO	NO
Phenol	0.29	1.65E+05	NO	NO

TABLE B-5
ROCKY FLATS OU6
INFREQUENTLY DETECTED COMPOUNDS
COMPARISON TO RBCs
POND SURFACE WATER

Chemical	Maximum Detected Conc (mg/l)	Residential Groundwater RBC (mg/l)	Max Conc > RBC?	Max Conc > 1000 x RBC?
Organic Compounds				
1,2-Dichloroethane	0.001	1.97E-04	YES	NO
Tetrachloroethene	0.012	1.43E-03	YES	NO

**TABLE B-6
ROCKY FLATS OU6
INFREQUENTLY DETECTED COMPOUNDS
WITHOUT RBCs**

Chemical
Groundwater
1,2,4-Trimethylbenzene
2-Hexanone
Pond Sediment
2-Methylnaphthalene
Dibenzofuran

APPENDIX C
TOTAL SUSPENDED AND DISSOLVED SOLIDS IN GROUNDWATER

**ROCKY FLATS PLANT OU-6
TOTAL SUSPENDED SOLIDS**

location	fieldid	date sampled	analyte	result	rep_lim	units	qual_lab	qual_wc
02691	GW02172IT	12/19/91	TOTAL SUSPENDED SOLIDS	660 00	4 00	MG/L		V
02691	GW02513IT	2/27/92	TOTAL SUSPENDED SOLIDS	410 00	4 00	MG/L		V
02691	GW02856IT	5/14/92	TOTAL SUSPENDED SOLIDS	350 00	4 00	MG/L		V
02691	GW03215IT	8/3/92	TOTAL SUSPENDED SOLIDS	564 00	5 00	MG/L		V
02691	GW03826IT	11/9/92	TOTAL SUSPENDED SOLIDS	830 00	4 00	MG/L		V
02691	GW00260WC	2/22/93	TOTAL SUSPENDED SOLIDS	420 00	5 00	MG/L		V
02691	GW00693WC	5/4/93	TOTAL SUSPENDED SOLIDS	360 00	5 00	MG/L		JA
02691	GW01218WC	8/30/93	TOTAL SUSPENDED SOLIDS	411 00	5 00	MG/L		V
02691	GW01630WC	11/30/93	TOTAL SUSPENDED SOLIDS	100 00	4 00	MG/L		V
0486	GW01456IT	6/20/91	TOTAL SUSPENDED SOLIDS	950 00	4 00	MG/L		V
0486	GW01763IT	9/12/91	TOTAL SUSPENDED SOLIDS	1400 00	4 00	MG/L		V
0486	GW02027IT	11/14/91	TOTAL SUSPENDED SOLIDS	4400 00	4 00	MG/L		V
0486	GW02613IT	4/1/92	TOTAL SUSPENDED SOLIDS	150 00	4 00	MG/L		V
0486	GW02957IT	6/11/92	TOTAL SUSPENDED SOLIDS	820 00	5 00	MG/L		
0486	GW03391IT	9/15/92	TOTAL SUSPENDED SOLIDS	1100 00	5 00	MG/L		V
0486	GW03807IT	11/18/92	TOTAL SUSPENDED SOLIDS	860 00	5 00	MG/L		V
0586	GW01538IT	7/18/91	TOTAL SUSPENDED SOLIDS	19 00	4 00	MG/L		V
0586	GW02670IT	4/23/92	TOTAL SUSPENDED SOLIDS	50 00	4 00	MG/L		V
0586	GW00549WC	4/15/93	TOTAL SUSPENDED SOLIDS	15 00	5 00	MG/L		V
0686	GW02671IT	4/15/92	TOTAL SUSPENDED SOLIDS	36 00	4 00	MG/L		V
0686	GW03150IT	7/16/92	TOTAL SUSPENDED SOLIDS	40 00	4 00	MG/L		V
1186	GW00998IT	3/18/91	TOTAL SUSPENDED SOLIDS	400 00	4 00	MG/L		
1186	GW01225IT	5/2/91	TOTAL SUSPENDED SOLIDS	290 00	4 00	MG/L		V
1186	GW01539IT	7/19/91	TOTAL SUSPENDED SOLIDS	60 00	4 00	MG/L		V
1186	GW01902IT	10/15/91	TOTAL SUSPENDED SOLIDS	210 00	4 00	MG/L		V
1186	GW02242IT	1/21/92	TOTAL SUSPENDED SOLIDS	220 00	4 00	MG/L		V
1186	GW02669IT	4/14/92	TOTAL SUSPENDED SOLIDS	580 00	4 00	MG/L		V
1186	GW03152IT	7/14/92	TOTAL SUSPENDED SOLIDS	750 00	4 00	MG/L		V
1186	GW03618IT	10/7/92	TOTAL SUSPENDED SOLIDS	150 00	5 00	MG/L		V
1286	GW02245IT	1/20/92	TOTAL SUSPENDED SOLIDS	730 00	4 00	MG/L		V
1286	GW02677IT	4/15/92	TOTAL SUSPENDED SOLIDS	21000 00	4 00	MG/L		V
1286	GW03095IT	7/13/92	TOTAL SUSPENDED SOLIDS	1400 00	4 00	MG/L		V
1386	GW00972IT	3/15/91	TOTAL SUSPENDED SOLIDS	28 00	4 00	MG/L		
1386	GW01210IT	4/24/91	TOTAL SUSPENDED SOLIDS	12 00	4 00	MG/L		V
1386	GW01482IT	7/16/91	TOTAL SUSPENDED SOLIDS	33 00	4 00	MG/L		
1386	GW01880IT	10/22/91	TOTAL SUSPENDED SOLIDS	35 00	4 00	MG/L		V
1386	GW02237IT	1/14/92	TOTAL SUSPENDED SOLIDS	38 00	4 00	MG/L		V
1386	GW02659IT	4/15/92	TOTAL SUSPENDED SOLIDS	15 00	4 00	MG/L		V
1386	GW03232IT	7/30/92	TOTAL SUSPENDED SOLIDS	6 00	4 00	MG/L		V
1386	GW03621IT	10/13/92	TOTAL SUSPENDED SOLIDS	44 00	5 00	MG/L		V
1386	GW00145WC	2/2/93	TOTAL SUSPENDED SOLIDS	20 00	5 00	MG/L		V
1386	GW00562WC	4/13/93	TOTAL SUSPENDED SOLIDS	14 00	5 00	MG/L		V
1386	GW01132WC	8/4/93	TOTAL SUSPENDED SOLIDS	58 00	4 00	MG/L		V
1386	GW01421WC	10/28/93	TOTAL SUSPENDED SOLIDS	27 00	5 00	MG/L		V
1386	GW00046GA	1/20/94	TOTAL SUSPENDED SOLIDS	37 00	4 00	MG/L		Y
1586	GW00904IT	3/4/91	TOTAL SUSPENDED SOLIDS	760 00	4 00	MG/L		
1586	GW01120IT	4/18/91	TOTAL SUSPENDED SOLIDS	130 00	4 00	MG/L		V
1586	GW01509IT	7/11/91	TOTAL SUSPENDED SOLIDS	130 00	4 00	MG/L		
1586	GW01882IT	10/21/91	TOTAL SUSPENDED SOLIDS	100 00	4 00	MG/L		V
1586	GW02240IT	1/15/92	TOTAL SUSPENDED SOLIDS	170 00	4 00	MG/L		V

**ROCKY FLATS PLANT OU-6
TOTAL SUSPENDED SOLIDS**

location	fieldid	date sampled	analyte	result	rep_lim	units	qual_lab	qual_wc
1586	GW026761T	4/13/92	TOTAL SUSPENDED SOLIDS	110.00	4.00	MG/L		V
1586	GW031821T	7/16/92	TOTAL SUSPENDED SOLIDS	360.00	4.00	MG/L		V
1586	GW036271T	10/7/92	TOTAL SUSPENDED SOLIDS	5.00	5.00	MG/L	U	V
1586	GW00136WC	2/5/93	TOTAL SUSPENDED SOLIDS	280.00	4.00	MG/L		V
1586	GW00555WC	4/13/93	TOTAL SUSPENDED SOLIDS	47.00	5.00	MG/L		V
1586	GW01125WC	8/2/93	TOTAL SUSPENDED SOLIDS	504.00	5.00	MG/L		V
1586	GW01415WC	10/20/93	TOTAL SUSPENDED SOLIDS	250.00	4.00	MG/L		V
1786	GW009051T	3/4/91	TOTAL SUSPENDED SOLIDS	1380.00		MG/L		V
1786	GW011161T	4/18/91	TOTAL SUSPENDED SOLIDS	1200.00	4.00	MG/L		V
1786	GW014741T	7/9/91	TOTAL SUSPENDED SOLIDS	2100.00	4.00	MG/L		
1786	GW018781T	10/10/91	TOTAL SUSPENDED SOLIDS	1300.00	4.00	MG/L		V
1786	GW022101T	1/9/92	TOTAL SUSPENDED SOLIDS	3300.00	4.00	MG/L		V
1786	GW026401T	4/7/92	TOTAL SUSPENDED SOLIDS	1500.00	4.00	MG/L		V
1786	GW031901T	7/27/92	TOTAL SUSPENDED SOLIDS	2100.00	4.00	MG/L		V
1786	GW036301T	10/7/92	TOTAL SUSPENDED SOLIDS	1590.00	5.00	MG/L		V
1786	GW00138WC	2/1/93	TOTAL SUSPENDED SOLIDS	11000.00	5.00	MG/L		V
1786	GW00557WC	4/16/93	TOTAL SUSPENDED SOLIDS	6700.00	4.00	MG/L		
1786	GW01127WC	8/2/93	TOTAL SUSPENDED SOLIDS	1274.00	5.00	MG/L		V
1786	GW01416WC	10/29/93	TOTAL SUSPENDED SOLIDS	1500.00	4.00	MG/L		V
3586	GW009761T	3/14/91	TOTAL SUSPENDED SOLIDS	130.00	4.00	MG/L		
3586	GW012211T	4/29/91	TOTAL SUSPENDED SOLIDS	170.00	4.00	MG/L		V
3586	GW014611T	7/9/91	TOTAL SUSPENDED SOLIDS	54.00	4.00	MG/L		
3586	GW018181T	10/8/91	TOTAL SUSPENDED SOLIDS	160.00	4.00	MG/L		V
3586	GW021951T	1/10/92	TOTAL SUSPENDED SOLIDS	100.00	4.00	MG/L		V
3586	GW026311T	4/7/92	TOTAL SUSPENDED SOLIDS	62.00	4.00	MG/L		V
3586	GW032171T	8/5/92	TOTAL SUSPENDED SOLIDS	5.00	5.00	MG/L	U	V
3586	GW038281T	12/10/92	TOTAL SUSPENDED SOLIDS	120.00	4.00	MG/L		V
3586	GW00262WC	3/5/93	TOTAL SUSPENDED SOLIDS	69.00	4.00	MG/L		V
3586	GW00695WC	5/6/93	TOTAL SUSPENDED SOLIDS	69.00	4.00	MG/L		V
3586	GW01244WC	9/22/93	TOTAL SUSPENDED SOLIDS	32.00	4.00	MG/L		V
3586	GW01701WC	12/13/93	TOTAL SUSPENDED SOLIDS	42.00	4.00	MG/L		Y
3686	GW012221T	4/30/91	TOTAL SUSPENDED SOLIDS	38.00	4.00	MG/L		V
3686	GW026321T	4/8/92	TOTAL SUSPENDED SOLIDS	33.00	4.00	MG/L		V
3786	GW009951T	3/19/91	TOTAL SUSPENDED SOLIDS	23.00	4.00	MG/L		
3786	GW012231T	4/30/91	TOTAL SUSPENDED SOLIDS	60.00	4.00	MG/L		V
3786	GW015211T	7/17/91	TOTAL SUSPENDED SOLIDS	26.00	4.00	MG/L		V
3786	GW018991T	10/15/91	TOTAL SUSPENDED SOLIDS	22.00	4.00	MG/L		V
3786	GW026561T	4/14/92	TOTAL SUSPENDED SOLIDS	32.00	4.00	MG/L		V
3786	GW032331T	9/18/92	TOTAL SUSPENDED SOLIDS	25.00	5.00	MG/L		V
3786	GW036411T	10/13/92	TOTAL SUSPENDED SOLIDS	49.00	5.00	MG/L		V
3786	GW01362WC	9/23/93	TOTAL SUSPENDED SOLIDS	50.00	4.00	MG/L		V
3786	GW01685WC	12/13/93	TOTAL SUSPENDED SOLIDS	19.00	4.00	MG/L		Y
3786	GW00155GA	1/27/94	TOTAL SUSPENDED SOLIDS	44.00	4.00	MG/L		Y
3886	GW012241T	5/6/91	TOTAL SUSPENDED SOLIDS	40.00	4.00	MG/L		V
3886	GW026571T	4/13/92	TOTAL SUSPENDED SOLIDS	28.00	4.00	MG/L		V
3886	GW00128WC	3/2/93	TOTAL SUSPENDED SOLIDS	20.00	5.00	MG/L		V
3886	GW00552WC	4/14/93	TOTAL SUSPENDED SOLIDS	61.00	5.00	MG/L		V
4087	GW015291T	7/17/91	TOTAL SUSPENDED SOLIDS	32.00	4.00	MG/L		
4087	GW023131T	2/21/92	TOTAL SUSPENDED SOLIDS	39.00	4.00	MG/L		V
4087	GW027901T	4/28/92	TOTAL SUSPENDED SOLIDS	19.00	4.00	MG/L		V

**ROCKY FLATS PLANT OU-6
TOTAL SUSPENDED SOLIDS**

location	fieldid	date sampled	analyte	result	rep_lm	units	qual_lab	qual_wc
4087	GW00501WC	4/20/93	TOTAL SUSPENDED SOLIDS	34 00	5 00	MG/L		V
41091	GW02171IT	12/20/91	TOTAL SUSPENDED SOLIDS	330 00	4 00	MG/L		V
41091	GW02609IT	3/17/92	TOTAL SUSPENDED SOLIDS	250 00	4 00	MG/L		V
41091	GW03050IT	6/11/92	TOTAL SUSPENDED SOLIDS	130 00	5 00	MG/L		
41091	GW03153IT	7/22/92	TOTAL SUSPENDED SOLIDS	660 00	4 00	MG/L		V
41091	GW03616IT	10/9/92	TOTAL SUSPENDED SOLIDS	287 00	5 00	MG/L		V
41091	GW00125WC	2/18/93	TOTAL SUSPENDED SOLIDS	190 00	4 00	MG/L		V
41091	GW00550WC	5/11/93	TOTAL SUSPENDED SOLIDS	42 00	5 00	MG/L		V
41091	GW01172WC	8/13/93	TOTAL SUSPENDED SOLIDS	110 00	4 00	MG/L		V
41091	GW01286WC	9/16/93	TOTAL SUSPENDED SOLIDS	4 00	4 00	MG/L	U	V
41091	GW01475WC	11/8/93	TOTAL SUSPENDED SOLIDS	80 00	5 00	MG/L		Y
41691	GW02090IT	12/7/91	TOTAL SUSPENDED SOLIDS	7000 00	4 00	MG/L		V
41691	GW02615IT	4/1/92	TOTAL SUSPENDED SOLIDS	1700 00	4 00	MG/L		V
41691	GW02953IT	6/11/92	TOTAL SUSPENDED SOLIDS	3300 00	5 00	MG/L		
41691	GW03396IT	9/16/92	TOTAL SUSPENDED SOLIDS	2240 00	5 00	MG/L		V
41691	GW03806IT	11/18/92	TOTAL SUSPENDED SOLIDS	910 00	4 00	MG/L		V
41691	GW00440WC	3/17/93	TOTAL SUSPENDED SOLIDS	860 00	4 00	MG/L		V
41691	GW01010WC	6/22/93	TOTAL SUSPENDED SOLIDS	1600 00	4 00	MG/L		V
41691	GW01357WC	9/20/93	TOTAL SUSPENDED SOLIDS	434 00	5 00	MG/L		V
41691	GW01549WC	12/9/93	TOTAL SUSPENDED SOLIDS	663 00	5 00	MG/L		Y
41691	GW00247GA	2/16/94	TOTAL SUSPENDED SOLIDS	140 00	4 00	MG/L		Y
41691	GW00248GA	2/16/94	TOTAL SUSPENDED SOLIDS	3000 00	4 00	MG/L		Y
41691	GW00275GA	2/18/94	TOTAL SUSPENDED SOLIDS	1500 00	4 00	MG/L		Y
41691	GW00274GA	2/18/94	TOTAL SUSPENDED SOLIDS	1860 00	5 00	MG/L		Y
41691	GW00290GA	2/21/94	TOTAL SUSPENDED SOLIDS	5200 00	4 00	MG/L		Y
41691	GW00291GA	2/24/94	TOTAL SUSPENDED SOLIDS	1200 00	4 00	MG/L		Y
41691	GW00400GA	3/3/94	TOTAL SUSPENDED SOLIDS	610 00	4 00	MG/L		Y
4287	GW01231IT	5/3/91	TOTAL SUSPENDED SOLIDS	140 00	4 00	MG/L		V
4287	GW02246IT	1/16/92	TOTAL SUSPENDED SOLIDS	95 00	4 00	MG/L		V
4287	GW02672IT	4/21/92	TOTAL SUSPENDED SOLIDS	88 00	4 00	MG/L		V
4287	GW00122WC	2/17/93	TOTAL SUSPENDED SOLIDS	310 00	4 00	MG/L		V
4287	GW00548WC	5/11/93	TOTAL SUSPENDED SOLIDS	320 00	5 00	MG/L		V
4287	GW00031GA	1/18/94	TOTAL SUSPENDED SOLIDS	175 00	5 00	MG/L		Y
7087	GW01540IT	7/19/91	TOTAL SUSPENDED SOLIDS	600 00	4 00	MG/L		V
7087	GW01957IT	10/31/91	TOTAL SUSPENDED SOLIDS	700 00	4 00	MG/L		V
7087	GW02303IT	2/21/92	TOTAL SUSPENDED SOLIDS	1100 00	4 00	MG/L		V
7087	GW02776IT	4/28/92	TOTAL SUSPENDED SOLIDS	250 00	4 00	MG/L		V
7087	GW03094IT	7/23/92	TOTAL SUSPENDED SOLIDS	1200 00	4 00	MG/L		V
7087	GW03608IT	10/6/92	TOTAL SUSPENDED SOLIDS	420 00	5 00	MG/L		V
7087	GW00523WC	4/12/93	TOTAL SUSPENDED SOLIDS	1100 00	5 00	MG/L		V
7087	GW01117WC	8/10/93	TOTAL SUSPENDED SOLIDS	836 00	5 00	MG/L		V
7087	GW00037GA	1/20/94	TOTAL SUSPENDED SOLIDS	480 00	4 00	MG/L		Y
7187	GW00903IT	3/4/91	TOTAL SUSPENDED SOLIDS	26 00	4 00	MG/L		
7187	GW01183IT	4/22/91	TOTAL SUSPENDED SOLIDS	57 00	4 00	MG/L		V
7187	GW01541IT	7/17/91	TOTAL SUSPENDED SOLIDS	53 00	4 00	MG/L		V
7187	GW01886IT	10/9/91	TOTAL SUSPENDED SOLIDS	97 00	4 00	MG/L		V
7187	GW02279IT	1/16/92	TOTAL SUSPENDED SOLIDS	18 50	4 00	MG/L		V
7187	GW02681IT	4/20/92	TOTAL SUSPENDED SOLIDS	26 00	4 00	MG/L		V
7187	GW03148IT	7/22/92	TOTAL SUSPENDED SOLIDS	92 00	4 00	MG/L		V
7187	GW03580IT	10/9/92	TOTAL SUSPENDED SOLIDS	51 00	5 00	MG/L		V

**ROCKY FLATS PLANT OU-6
TOTAL SUSPENDED SOLIDS**

location	fieldid	date sampled	analyte	result	rep_hm	units	qual_lab	qual_wc
7187	GW00091WC	2/19/93	TOTAL SUSPENDED SOLIDS	45.50	4.00	MG/L		V
7187	GW00502WC	4/9/93	TOTAL SUSPENDED SOLIDS	79.50	4.00	MG/L		V
7187	GW01094WC	8/11/93	TOTAL SUSPENDED SOLIDS	227.00	5.00	MG/L		V
7187	GW01434WC	11/3/93	TOTAL SUSPENDED SOLIDS	16.00	4.00	MG/L		V
7287	GW00944IT	3/11/91	TOTAL SUSPENDED SOLIDS	580.00	4.00	MG/L		
7287	GW01212IT	4/23/91	TOTAL SUSPENDED SOLIDS	640.00	4.00	MG/L		V
7287	GW01524IT	7/15/91	TOTAL SUSPENDED SOLIDS	360.00	4.00	MG/L		
7287	GW02309IT	2/20/92	TOTAL SUSPENDED SOLIDS	1800.00	4.00	MG/L		V
7287	GW02783IT	4/23/92	TOTAL SUSPENDED SOLIDS	1800.00	4.00	MG/L		V
7287	GW03089IT	7/7/92	TOTAL SUSPENDED SOLIDS	3000.00	4.00	MG/L		V
7287	GW03604IT	10/7/92	TOTAL SUSPENDED SOLIDS	619.00	5.00	MG/L		V
7287	GW00113WC	2/1/93	TOTAL SUSPENDED SOLIDS	17000.00	5.00	MG/L		V
7287	GW00519WC	4/8/93	TOTAL SUSPENDED SOLIDS	2500.00	4.00	MG/L		V
7287	GW01113WC	8/9/93	TOTAL SUSPENDED SOLIDS	9382.00	5.00	MG/L		V
7287	GW01391WC	10/13/93	TOTAL SUSPENDED SOLIDS	5000.00	4.00	MG/L		V
76292	GW00467WC	3/22/93	TOTAL SUSPENDED SOLIDS	20.00	5.00	MG/L		
76292	GW00533WC	4/21/93	TOTAL SUSPENDED SOLIDS	700.00	5.00	MG/L		
77492	GW00469WC	3/22/93	TOTAL SUSPENDED SOLIDS	1300.00	5.00	MG/L		
77492	GW00534WC	4/21/93	TOTAL SUSPENDED SOLIDS	3500.00	5.00	MG/L		
B206489	GW00956IT	3/12/91	TOTAL SUSPENDED SOLIDS	81.00	5.00	MG/L		JA
B206489	GW01525IT	7/16/91	TOTAL SUSPENDED SOLIDS	19.00	4.00	MG/L		
B206489	GW01959IT	10/31/91	TOTAL SUSPENDED SOLIDS	20.00	4.00	MG/L		V
B206489	GW02310IT	2/20/92	TOTAL SUSPENDED SOLIDS	14.00	4.00	MG/L		V
B206489	GW02720IT	4/16/92	TOTAL SUSPENDED SOLIDS	21.00	4.00	MG/L		V
B206489	GW03246IT	7/30/92	TOTAL SUSPENDED SOLIDS	9.00	4.00	MG/L		V
B206489	GW00116WC	2/2/93	TOTAL SUSPENDED SOLIDS	9.00	5.00	MG/L		V
B206489	GW00522WC	4/8/93	TOTAL SUSPENDED SOLIDS	31.00	4.00	MG/L		V
B206589	GW00943IT	3/12/91	TOTAL SUSPENDED SOLIDS	8.00	5.00	MG/L		JA
B206589	GW01526IT	7/16/91	TOTAL SUSPENDED SOLIDS	340.00	4.00	MG/L		
B206589	GW01961IT	10/31/91	TOTAL SUSPENDED SOLIDS	4.00	4.00	MG/L	U	V
B206589	GW02311IT	2/7/92	TOTAL SUSPENDED SOLIDS	4.00	4.00	MG/L		V
B206589	GW02721IT	4/21/92	TOTAL SUSPENDED SOLIDS	4.00	4.00	MG/L	U	V
B206589	GW03091IT	7/14/92	TOTAL SUSPENDED SOLIDS	4.00	4.00	MG/L	U	V
B206589	GW03609IT	10/6/92	TOTAL SUSPENDED SOLIDS	5.00	5.00	MG/L	U	V
B206589	GW00118WC	2/2/93	TOTAL SUSPENDED SOLIDS	5.00	5.00	MG/L	U	V
B206589	GW00524WC	4/16/93	TOTAL SUSPENDED SOLIDS	35.00	4.00	MG/L		
B206589	GW01118WC	8/12/93	TOTAL SUSPENDED SOLIDS	4.00	4.00	MG/L	U	V
B206589	GW01406WC	11/5/93	TOTAL SUSPENDED SOLIDS	5.00	4.00	MG/L		V
B206589	GW00038GA	1/20/94	TOTAL SUSPENDED SOLIDS	4.00	4.00	MG/L	U	Y
B206689	GW00953IT	3/12/91	TOTAL SUSPENDED SOLIDS	6.00	5.00	MG/L		JA
B206689	GW01527IT	7/16/91	TOTAL SUSPENDED SOLIDS	4.00	4.00	MG/L	U	
B206689	GW01962IT	10/31/91	TOTAL SUSPENDED SOLIDS	5.00	4.00	MG/L		V
B206689	GW02312IT	2/22/92	TOTAL SUSPENDED SOLIDS	5.00	4.00	MG/L		V
B206689	GW02722IT	4/23/92	TOTAL SUSPENDED SOLIDS	4.00	4.00	MG/L	U	V
B206689	GW03092IT	7/16/92	TOTAL SUSPENDED SOLIDS	4.00	4.00	MG/L	U	V
B206689	GW03610IT	10/6/92	TOTAL SUSPENDED SOLIDS	5.00	5.00	MG/L	U	V
B206689	GW00119WC	2/11/93	TOTAL SUSPENDED SOLIDS	11.00	4.00	MG/L		V
B206689	GW00525WC	4/21/93	TOTAL SUSPENDED SOLIDS	23.00	5.00	MG/L		V
B206689	GW01119WC	8/10/93	TOTAL SUSPENDED SOLIDS	9.00	5.00	MG/L	U	JA
B206689	GW01407WC	10/18/93	TOTAL SUSPENDED SOLIDS	6.80	5.00	MG/L	U	V

**ROCKY FLATS PLANT OU-6
TOTAL SUSPENDED SOLIDS**

location	fieldid	date sampled	analyte	result	rep_lm	units	qual_lab	qual_wc
B206689	GW00040GA	1/25/94	TOTAL SUSPENDED SOLIDS	9 00	4 00	MG/L		Y
B206889	GW00951IT	3/12/91	TOTAL SUSPENDED SOLIDS	29 00	5 00	MG/L		JA
B206889	GW00527WC	4/22/93	TOTAL SUSPENDED SOLIDS	29 00	4 00	MG/L		V
B208089	GW01472IT	7/10/91	TOTAL SUSPENDED SOLIDS	6 00	4 00	MG/L		
B208089	GW01820IT	10/8/91	TOTAL SUSPENDED SOLIDS	21 00	4 00	MG/L		V
B208089	GW02197IT	1/10/92	TOTAL SUSPENDED SOLIDS	28 00	4 00	MG/L		V
B208089	GW02635IT	4/10/92	TOTAL SUSPENDED SOLIDS	54 00	4 00	MG/L		V
B208089	GW03133IT	7/15/92	TOTAL SUSPENDED SOLIDS	24 00	4 00	MG/L		V
B208089	GW03632IT	10/6/92	TOTAL SUSPENDED SOLIDS	43 00	5 00	MG/L		JA
B208089	GW00558WC	4/23/93	TOTAL SUSPENDED SOLIDS	22 00	4 00	MG/L		V
B208089	GW01128WC	7/28/93	TOTAL SUSPENDED SOLIDS	15 00	4 00	MG/L		V
B208589	GW02227IT	1/14/92	TOTAL SUSPENDED SOLIDS	10 00	4 00	MG/L		V
B208589	GW02654IT	4/10/92	TOTAL SUSPENDED SOLIDS	22 00	4 00	MG/L		V
B208789	GW02208IT	1/14/92	TOTAL SUSPENDED SOLIDS	21 00	4 00	MG/L		V
B208789	GW02638IT	4/9/92	TOTAL SUSPENDED SOLIDS	9 00	4 00	MG/L		V
B208789	GW03132IT	7/21/92	TOTAL SUSPENDED SOLIDS	8 00	4 00	MG/L		V
B208789	GW03623IT	10/6/92	TOTAL SUSPENDED SOLIDS	5 00	5 00	MG/L	U	V
B210489	GW01516IT	7/15/91	TOTAL SUSPENDED SOLIDS	1200 00	4 00	MG/L		
B210489	GW01883IT	10/21/91	TOTAL SUSPENDED SOLIDS	20 00	4 00	MG/L		V
B210489	GW02228IT	1/13/92	TOTAL SUSPENDED SOLIDS	66 00	4 00	MG/L		V
B210489	GW02655IT	4/10/92	TOTAL SUSPENDED SOLIDS	34 00	4 00	MG/L		V
B210489	GW03185IT	7/20/92	TOTAL SUSPENDED SOLIDS	44 00	4 00	MG/L		V
B210489	GW03639IT	10/8/92	TOTAL SUSPENDED SOLIDS	5 00	5 00	MG/L	U	V
B210489	GW00144WC	2/2/93	TOTAL SUSPENDED SOLIDS	13 00	5 00	MG/L		V
B210489	GW00637WC	4/19/93	TOTAL SUSPENDED SOLIDS	7 00	5 00	MG/L		JA
B210489	GW01131WC	8/4/93	TOTAL SUSPENDED SOLIDS	102 00	5 00	MG/L		V
B210489	GW01420WC	10/20/93	TOTAL SUSPENDED SOLIDS	12 00	4 00	MG/L		V
B210489	GW00045GA	1/20/94	TOTAL SUSPENDED SOLIDS	7 00	4 00	MG/L		Y
P209789	GW01025IT	3/26/91	TOTAL SUSPENDED SOLIDS	140 00	4 00	MG/L		V
P209789	GW01610IT	8/1/91	TOTAL SUSPENDED SOLIDS	26 00	4 00	MG/L		
P209789	GW01837IT	10/11/91	TOTAL SUSPENDED SOLIDS	15 00	4 00	MG/L		V
P209789	GW02239IT	1/20/92	TOTAL SUSPENDED SOLIDS	420 00	4 00	MG/L		V
P209789	GW02759IT	4/24/92	TOTAL SUSPENDED SOLIDS	12 00	4 00	MG/L		V
P209789	GW03186IT	7/20/92	TOTAL SUSPENDED SOLIDS	14 00	4 00	MG/L		V
P209789	GW03551IT	10/16/92	TOTAL SUSPENDED SOLIDS	54 50	5 00	MG/L		V
P209789	GW00021WC	2/9/93	TOTAL SUSPENDED SOLIDS	8 00	5 00	MG/L		V
P209789	GW00493WC	4/6/93	TOTAL SUSPENDED SOLIDS	5 00	5 00	MG/L	U	V
P209789	GW01048WC	7/16/93	TOTAL SUSPENDED SOLIDS	81 00	4 00	MG/L		V
P209789	GW01379WC	10/15/93	TOTAL SUSPENDED SOLIDS	5 00	4 00	MG/L		V
P218389	GW01522WC	11/16/93	TOTAL SUSPENDED SOLIDS	224 00	5 00	MG/L		V
P219489	GW01523WC	11/16/93	TOTAL SUSPENDED SOLIDS	52 00	5 00	MG/L		V

**ROCKY FLATS PLANT OU-6
TOTAL DISSOLVED SOLIDS**

location	fieldid	date sampled	analyte	result	rep_lim	units	qual_lab	qual_wc
02691	GW02172IT	12/19/91	TOTAL DISSOLVED SOLIDS	450 00	10 00	MG/L		V
02691	GW02513IT	2/27/92	TOTAL DISSOLVED SOLIDS	440 00	10 00	MG/L		V
02691	GW02856IT	5/14/92	TOTAL DISSOLVED SOLIDS	330 00	10 00	MG/L		V
02691	GW03215IT	8/3/92	TOTAL DISSOLVED SOLIDS	500 00	10 00	MG/L		V
02691	GW03826IT	11/9/92	TOTAL DISSOLVED SOLIDS	470 00	10 00	MG/L		V
02691	GW00260WC	2/22/93	TOTAL DISSOLVED SOLIDS	450 00	14 00	MG/L		V
02691	GW00693WC	5/4/93	TOTAL DISSOLVED SOLIDS	440 00	14 00	MG/L		JA
02691	GW01218WC	8/30/93	TOTAL DISSOLVED SOLIDS	396 00	14 00	MG/L		V
02691	GW01630WC	11/30/93	TOTAL DISSOLVED SOLIDS	440 00	10 00	MG/L		V
0486	GW01456IT	6/20/91	TOTAL DISSOLVED SOLIDS	370 00	10 00	MG/L		V
0486	GW01763IT	9/12/91	TOTAL DISSOLVED SOLIDS	370 00	10 00	MG/L		V
0486	GW02027IT	11/14/91	TOTAL DISSOLVED SOLIDS	440 00	10 00	MG/L		V
0486	GW02613IT	4/1/92	TOTAL DISSOLVED SOLIDS	400 00	10 00	MG/L		V
0486	GW02957IT	6/11/92	TOTAL DISSOLVED SOLIDS	510 00	5 00	MG/L		
0486	GW03391IT	9/15/92	TOTAL DISSOLVED SOLIDS	350 00	14 00	MG/L		V
0486	GW03807IT	11/18/92	TOTAL DISSOLVED SOLIDS	410 00	14 00	MG/L		V
0586	GW01538IT	7/18/91	TOTAL DISSOLVED SOLIDS	5100 00	10 00	MG/L		V
0586	GW02670IT	4/23/92	TOTAL DISSOLVED SOLIDS	4300 00	10 00	MG/L		V
0586	GW00549WC	4/15/93	TOTAL DISSOLVED SOLIDS	4700 00	14 00	MG/L		V
0686	GW02671IT	4/15/92	TOTAL DISSOLVED SOLIDS	1900 00	10 00	MG/L		V
0686	GW03150IT	7/16/92	TOTAL DISSOLVED SOLIDS	3600 00	10 00	MG/L		V
1186	GW00998IT	3/18/91	TOTAL DISSOLVED SOLIDS	490 00	10 00	MG/L		
1186	GW01225IT	5/2/91	TOTAL DISSOLVED SOLIDS	510 00	10 00	MG/L		V
1186	GW01539IT	7/19/91	TOTAL DISSOLVED SOLIDS	560 00	10 00	MG/L		V
1186	GW01902IT	10/15/91	TOTAL DISSOLVED SOLIDS	560 00	10 00	MG/L		V
1186	GW02242IT	1/21/92	TOTAL DISSOLVED SOLIDS	520 00	10 00	MG/L		V
1186	GW02669IT	4/14/92	TOTAL DISSOLVED SOLIDS	500 00	10 00	MG/L		V
1186	GW03152IT	7/14/92	TOTAL DISSOLVED SOLIDS	580 00	10 00	MG/L		V
1186	GW03618IT	10/7/92	TOTAL DISSOLVED SOLIDS	530 00	14 00	MG/L		V
1286	GW02245IT	1/20/92	TOTAL DISSOLVED SOLIDS	1600 00	10 00	MG/L		V
1286	GW02677IT	4/15/92	TOTAL DISSOLVED SOLIDS	1000 00	10 00	MG/L		V
1286	GW03095IT	7/13/92	TOTAL DISSOLVED SOLIDS	1100 00	10 00	MG/L		V
1386	GW00972IT	3/15/91	TOTAL DISSOLVED SOLIDS	690 00	10 00	MG/L		
1386	GW01210IT	4/24/91	TOTAL DISSOLVED SOLIDS	690 00	10 00	MG/L		V
1386	GW01482IT	7/16/91	TOTAL DISSOLVED SOLIDS	770 00	10 00	MG/L		
1386	GW01880IT	10/22/91	TOTAL DISSOLVED SOLIDS	720 00	10 00	MG/L		V
1386	GW02237IT	1/14/92	TOTAL DISSOLVED SOLIDS	710 00	10 00	MG/L		V
1386	GW02659IT	4/15/92	TOTAL DISSOLVED SOLIDS	690 00	10 00	MG/L		V
1386	GW03232IT	7/30/92	TOTAL DISSOLVED SOLIDS	760 00	10 00	MG/L		V
1386	GW03621IT	10/13/92	TOTAL DISSOLVED SOLIDS	690 00	14 00	MG/L		V
1386	GW00145WC	2/2/93	TOTAL DISSOLVED SOLIDS	780 00	14 00	MG/L		V
1386	GW00562WC	4/13/93	TOTAL DISSOLVED SOLIDS	740 00	14 00	MG/L		V
1386	GW01132WC	8/4/93	TOTAL DISSOLVED SOLIDS	770 00	10 00	MG/L		V
1386	GW01421WC	10/28/93	TOTAL DISSOLVED SOLIDS	751 00	14 00	MG/L		V
1386	GW00046CA	1/20/94	TOTAL DISSOLVED SOLIDS	700 00	10 00	MG/L		Y
1586	GW00904IT	3/4/91	TOTAL DISSOLVED SOLIDS	1100 00	10 00	MG/L		
1586	GW01120IT	4/18/91	TOTAL DISSOLVED SOLIDS	1000 00	10 00	MG/L		V
1586	GW01509IT	7/11/91	TOTAL DISSOLVED SOLIDS	1200 00	10 00	MG/L		
1586	GW01882IT	10/21/91	TOTAL DISSOLVED SOLIDS	1100 00	10 00	MG/L		V
1586	GW02240IT	1/15/92	TOTAL DISSOLVED SOLIDS	1000 00	10 00	MG/L		V
1586	GW02676IT	4/13/92	TOTAL DISSOLVED SOLIDS	1100 00	10 00	MG/L		V
1586	GW03182IT	7/16/92	TOTAL DISSOLVED SOLIDS	1200 00	10 00	MG/L		V
1586	GW03627IT	10/7/92	TOTAL DISSOLVED SOLIDS	1100 00	10 00	MG/L		V
1586	GW00136WC	2/5/93	TOTAL DISSOLVED SOLIDS	1000 00	10 00	MG/L		V
1586	GW00555WC	4/13/93	TOTAL DISSOLVED SOLIDS	1100 00	14 00	MG/L		V
1586	GW01125WC	8/2/93	TOTAL DISSOLVED SOLIDS	1097 00	14 00	MG/L		JA
1586	GW01415WC	10/20/93	TOTAL DISSOLVED SOLIDS	1100 00	10 00	MG/L		V

**ROCKY FLATS PLANT OU-6
TOTAL DISSOLVED SOLIDS**

location	fieldid	date sampled	analyte	result	rep_hm	units	qual_lab	qual_wc
1786	GW009051T	3/4/91	TOTAL DISSOLVED SOLIDS	4420 00		MG/L		V
1786	GW011161T	4/18/91	TOTAL DISSOLVED SOLIDS	5000 00	10 00	MG/L		V
1786	GW014741T	7/9/91	TOTAL DISSOLVED SOLIDS	5000 00	10 00	MG/L		
1786	GW018781T	10/10/91	TOTAL DISSOLVED SOLIDS	4100 00	10 00	MG/L		V
1786	GW026401T	4/7/92	TOTAL DISSOLVED SOLIDS	3700 00	10 00	MG/L		V
1786	GW031901T	7/27/92	TOTAL DISSOLVED SOLIDS	4900 00	10 00	MG/L		V
1786	GW036301T	10/7/92	TOTAL DISSOLVED SOLIDS	4360 00	10 00	MG/L		V
1786	GW00138WC	2/1/93	TOTAL DISSOLVED SOLIDS	4400 00	14 00	MG/L		V
1786	GW00557WC	4/16/93	TOTAL DISSOLVED SOLIDS	4600 00	10 00	MG/L		
1786	GW01127WC	8/2/93	TOTAL DISSOLVED SOLIDS	4331 00	14 00	MG/L		JA
1786	GW01416WC	10/29/93	TOTAL DISSOLVED SOLIDS	3900 00	10 00	MG/L		V
3586	GW009761T	3/14/91	TOTAL DISSOLVED SOLIDS	950 00	10 00	MG/L		
3586	GW012211T	4/29/91	TOTAL DISSOLVED SOLIDS	920 00	10 00	MG/L		V
3586	GW014611T	7/9/91	TOTAL DISSOLVED SOLIDS	950 00	10 00	MG/L		
3586	GW018181T	10/8/91	TOTAL DISSOLVED SOLIDS	980 00	10 00	MG/L		V
3586	GW021951T	1/10/92	TOTAL DISSOLVED SOLIDS	920 00	10 00	MG/L		V
3586	GW026311T	4/7/92	TOTAL DISSOLVED SOLIDS	1000 00	10 00	MG/L		V
3586	GW032171T	8/5/92	TOTAL DISSOLVED SOLIDS	1000 00	14 00	MG/L		V
3586	GW038281T	12/10/92	TOTAL DISSOLVED SOLIDS	950 00	10 00	MG/L		V
3586	GW00262WC	3/5/93	TOTAL DISSOLVED SOLIDS	810 00	10 00	MG/L		V
3586	GW00695WC	5/6/93	TOTAL DISSOLVED SOLIDS	900 00	10 00	MG/L		V
3586	GW01244WC	9/22/93	TOTAL DISSOLVED SOLIDS	930 00	10 00	MG/L		V
3586	GW01701WC	12/13/93	TOTAL DISSOLVED SOLIDS	900 00	10 00	MG/L		Y
3686	GW012221T	4/30/91	TOTAL DISSOLVED SOLIDS	1400 00	10 00	MG/L		V
3686	GW026321T	4/8/92	TOTAL DISSOLVED SOLIDS	1200 00	10 00	MG/L		V
3786	GW009951T	3/19/91	TOTAL DISSOLVED SOLIDS	2200 00	10 00	MG/L		
3786	GW012231T	4/30/91	TOTAL DISSOLVED SOLIDS	1900 00	10 00	MG/L		V
3786	GW015211T	7/17/91	TOTAL DISSOLVED SOLIDS	2100 00	10 00	MG/L		V
3786	GW018991T	10/15/91	TOTAL DISSOLVED SOLIDS	1900 00	10 00	MG/L		V
3786	GW026561T	4/14/92	TOTAL DISSOLVED SOLIDS	2300 00	10 00	MG/L		V
3786	GW032331T	9/18/92	TOTAL DISSOLVED SOLIDS	2450 00	10 00	MG/L		V
3786	GW036411T	10/13/92	TOTAL DISSOLVED SOLIDS	2500 00	14 00	MG/L		V
3786	GW01362WC	9/23/93	TOTAL DISSOLVED SOLIDS	2400 00	10 00	MG/L		V
3786	GW01685WC	12/13/93	TOTAL DISSOLVED SOLIDS	2300 00	10 00	MG/L		Y
3786	GW00155GA	1/27/94	TOTAL DISSOLVED SOLIDS	2200 00	10 00	MG/L		Y
3886	GW012241T	5/6/91	TOTAL DISSOLVED SOLIDS	1400 00	10 00	MG/L		V
3886	GW026571T	4/13/92	TOTAL DISSOLVED SOLIDS	1600 00	10 00	MG/L		V
3886	GW00128WC	3/2/93	TOTAL DISSOLVED SOLIDS	1600 00	14 00	MG/L		V
3886	GW00552WC	4/14/93	TOTAL DISSOLVED SOLIDS	1900 00	14 00	MG/L		V
4087	GW015291T	7/17/91	TOTAL DISSOLVED SOLIDS	1400 00	10 00	MG/L		
4087	GW023131T	2/21/92	TOTAL DISSOLVED SOLIDS	1000 00	10 00	MG/L		V
4087	GW027901T	4/28/92	TOTAL DISSOLVED SOLIDS	1000 00	10 00	MG/L		V
4087	GW00501WC	4/20/93	TOTAL DISSOLVED SOLIDS	850 00	14 00	MG/L		V
41091	GW021711T	12/20/91	TOTAL DISSOLVED SOLIDS	530 00	10 00	MG/L		V
41091	GW026091T	3/17/92	TOTAL DISSOLVED SOLIDS	550 00	10 00	MG/L		V
41091	GW030501T	6/11/92	TOTAL DISSOLVED SOLIDS	600 00	5 00	MG/L		
41091	GW031531T	7/22/92	TOTAL DISSOLVED SOLIDS	440 00	10 00	MG/L		V
41091	GW036161T	10/9/92	TOTAL DISSOLVED SOLIDS	632 00	10 00	MG/L		V
41091	GW00125WC	2/18/93	TOTAL DISSOLVED SOLIDS	430 00	10 00	MG/L		V
41091	GW00550WC	5/11/93	TOTAL DISSOLVED SOLIDS	520 00	14 00	MG/L		V
41091	GW01172WC	8/13/93	TOTAL DISSOLVED SOLIDS	480 00	10 00	MG/L		V
41091	GW01286WC	9/16/93	TOTAL DISSOLVED SOLIDS	520 00	10 00	MG/L		V
41091	GW01475WC	11/8/93	TOTAL DISSOLVED SOLIDS	524 00	14 00	MG/L		Y
41691	GW020901T	12/7/91	TOTAL DISSOLVED SOLIDS	430 00	10 00	MG/L		V
41691	GW026151T	4/1/92	TOTAL DISSOLVED SOLIDS	680 00	10 00	MG/L		V
41691	GW029531T	6/11/92	TOTAL DISSOLVED SOLIDS	560 00	5 00	MG/L		
41691	GW033961T	9/16/92	TOTAL DISSOLVED SOLIDS	528 00	10 00	MG/L		V

**ROCKY FLATS PLANT OU-6
TOTAL DISSOLVED SOLIDS**

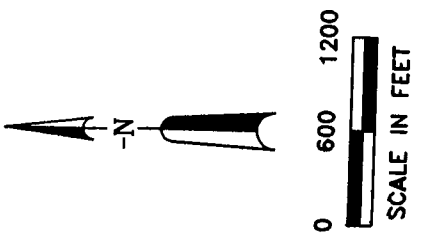
location	fieldid	date sampled	analyte	result	rep_hm	units	qual_lab	qual_wc
41691	GW038061T	11/18/92	TOTAL DISSOLVED SOLIDS	410 00	10 00	MG/L		V
41691	GW00440WC	3/17/93	TOTAL DISSOLVED SOLIDS	310 00	10 00	MG/L		V
41691	GW01010WC	6/22/93	TOTAL DISSOLVED SOLIDS	540 00	10 00	MG/L		V
41691	GW01357WC	9/20/93	TOTAL DISSOLVED SOLIDS	396 00	14 00	MG/L		V
41691	GW01549WC	12/9/93	TOTAL DISSOLVED SOLIDS	400 00	14 00	MG/L		Y
41691	GW00247GA	2/16/94	TOTAL DISSOLVED SOLIDS	410 00	10 00	MG/L		Y
41691	GW00248GA	2/16/94	TOTAL DISSOLVED SOLIDS	490 00	10 00	MG/L		Y
41691	GW00274GA	2/18/94	TOTAL DISSOLVED SOLIDS	388 00	10 00	MG/L		Y
41691	GW00275GA	2/18/94	TOTAL DISSOLVED SOLIDS	560 00	10 00	MG/L		Y
41691	GW00290GA	2/21/94	TOTAL DISSOLVED SOLIDS	830 00	10 00	MG/L		Y
41691	GW00291GA	2/24/94	TOTAL DISSOLVED SOLIDS	640 00	10 00	MG/L		Y
41691	GW00400GA	3/3/94	TOTAL DISSOLVED SOLIDS	460 00	10 00	MG/L		Y
4287	GW01231IT	5/3/91	TOTAL DISSOLVED SOLIDS	350 00	10 00	MG/L		V
4287	GW02246IT	1/16/92	TOTAL DISSOLVED SOLIDS	330 00	10 00	MG/L		V
4287	GW02672IT	4/21/92	TOTAL DISSOLVED SOLIDS	310 00	10 00	MG/L		V
4287	GW00122WC	2/17/93	TOTAL DISSOLVED SOLIDS	280 00	10 00	MG/L		V
4287	GW00548WC	5/11/93	TOTAL DISSOLVED SOLIDS	360 00	14 00	MG/L		V
4287	GW00031GA	1/18/94	TOTAL DISSOLVED SOLIDS	374 00	14 00	MG/L		Y
7087	GW01540IT	7/19/91	TOTAL DISSOLVED SOLIDS	500 00	10 00	MG/L		V
7087	GW01957IT	10/31/91	TOTAL DISSOLVED SOLIDS	510 00	10 00	MG/L		V
7087	GW02303IT	2/21/92	TOTAL DISSOLVED SOLIDS	500 00	10 00	MG/L		V
7087	GW02776IT	4/28/92	TOTAL DISSOLVED SOLIDS	450 00	10 00	MG/L		V
7087	GW03094IT	7/23/92	TOTAL DISSOLVED SOLIDS	520 00	10 00	MG/L		V
7087	GW03608IT	10/6/92	TOTAL DISSOLVED SOLIDS	550 00	14 00	MG/L		V
7087	GW00523WC	4/12/93	TOTAL DISSOLVED SOLIDS	520 00	14 00	MG/L		V
7087	GW01117WC	8/10/93	TOTAL DISSOLVED SOLIDS	527 00	14 00	MG/L		V
7087	GW00037GA	1/20/94	TOTAL DISSOLVED SOLIDS	470 00	10 00	MG/L		Y
7187	GW00903IT	3/4/91	TOTAL DISSOLVED SOLIDS	260 00	10 00	MG/L		
7187	GW01183IT	4/22/91	TOTAL DISSOLVED SOLIDS	270 00	10 00	MG/L		V
7187	GW01541IT	7/17/91	TOTAL DISSOLVED SOLIDS	300 00	10 00	MG/L		V
7187	GW01886IT	10/9/91	TOTAL DISSOLVED SOLIDS	300 00	10 00	MG/L		V
7187	GW02279IT	1/16/92	TOTAL DISSOLVED SOLIDS	235 00	10 00	MG/L		V
7187	GW02681IT	4/20/92	TOTAL DISSOLVED SOLIDS	275 00	10 00	MG/L		V
7187	GW03148IT	7/22/92	TOTAL DISSOLVED SOLIDS	290 00	10 00	MG/L		V
7187	GW03580IT	10/9/92	TOTAL DISSOLVED SOLIDS	302 00	10 00	MG/L		V
7187	GW00091WC	2/19/93	TOTAL DISSOLVED SOLIDS	255 00	10 00	MG/L		V
7187	GW00502WC	4/9/93	TOTAL DISSOLVED SOLIDS	260 00	10 00	MG/L		V
7187	GW01094WC	8/11/93	TOTAL DISSOLVED SOLIDS	281 50	14 00	MG/L		V
7187	GW01434WC	11/3/93	TOTAL DISSOLVED SOLIDS	275 00	10 00	MG/L		V
7287	GW00944IT	3/11/91	TOTAL DISSOLVED SOLIDS	300 00	10 00	MG/L		
7287	GW01212IT	4/23/91	TOTAL DISSOLVED SOLIDS	300 00	10 00	MG/L		V
7287	GW01524IT	7/15/91	TOTAL DISSOLVED SOLIDS	360 00	10 00	MG/L		
7287	GW02309IT	2/20/92	TOTAL DISSOLVED SOLIDS	340 00	10 00	MG/L		V
7287	GW02783IT	4/23/92	TOTAL DISSOLVED SOLIDS	400 00	10 00	MG/L		V
7287	GW03089IT	7/7/92	TOTAL DISSOLVED SOLIDS	220 00	10 00	MG/L		V
7287	GW03604IT	10/7/92	TOTAL DISSOLVED SOLIDS	380 00	10 00	MG/L		V
7287	GW00113WC	2/1/93	TOTAL DISSOLVED SOLIDS	350 00	14 00	MG/L		V
7287	GW00519WC	4/8/93	TOTAL DISSOLVED SOLIDS	340 00	10 00	MG/L		V
7287	GW01113WC	8/9/93	TOTAL DISSOLVED SOLIDS	307 00	14 00	MG/L		V
7287	GW01391WC	10/13/93	TOTAL DISSOLVED SOLIDS	380 00	10 00	MG/L		V
76292	GW00467WC	3/22/93	TOTAL DISSOLVED SOLIDS	430 00	14 00	MG/L		
76292	GW00533WC	4/21/93	TOTAL DISSOLVED SOLIDS	380 00	14 00	MG/L		
77492	GW00469WC	3/22/93	TOTAL DISSOLVED SOLIDS	760 00	14 00	MG/L		
77492	GW00534WC	4/21/93	TOTAL DISSOLVED SOLIDS	740 00	14 00	MG/L		
B206489	GW009561T	3/12/91	TOTAL DISSOLVED SOLIDS	308 00	10 00	MG/L		V
B206489	GW015251T	7/16/91	TOTAL DISSOLVED SOLIDS	370 00	10 00	MG/L		
B206489	GW01959IT	10/31/91	TOTAL DISSOLVED SOLIDS	360 00	10 00	MG/L		V

**ROCKY FLATS PLANT OU-6
TOTAL DISSOLVED SOLIDS**

Location	Wellid	date sampled	analyte	result	rep_lim	units	qual_lab	qual_wc
P206489	GW023101T	2/20/92	TOTAL DISSOLVED SOLIDS	320.00	10.00	MG/L		V
B206489	GW027201T	4/16/92	TOTAL DISSOLVED SOLIDS	430.00	10.00	MG/L		V
B206489	GW032461T	7/30/92	TOTAL DISSOLVED SOLIDS	420.00	10.00	MG/L		V
B206489	GW00116WC	2/2/93	TOTAL DISSOLVED SOLIDS	340.00	14.00	MG/L		V
B206489	GW00522WC	4/8/93	TOTAL DISSOLVED SOLIDS	330.00	10.00	MG/L		V
B206589	GW009431T	3/12/91	TOTAL DISSOLVED SOLIDS	504.00	10.00	MG/L		V
B206589	GW015261T	7/16/91	TOTAL DISSOLVED SOLIDS	1500.00	10.00	MG/L		
B206589	GW019611T	10/31/91	TOTAL DISSOLVED SOLIDS	520.00	10.00	MG/L		V
B206589	GW023111T	2/7/92	TOTAL DISSOLVED SOLIDS	560.00	10.00	MG/L		V
B206589	GW027211T	4/21/92	TOTAL DISSOLVED SOLIDS	580.00	10.00	MG/L		V
B206589	GW030911T	7/14/92	TOTAL DISSOLVED SOLIDS	560.00	10.00	MG/L		V
B206589	GW036091T	10/6/92	TOTAL DISSOLVED SOLIDS	570.00	14.00	MG/L		V
P206589	GW00118WC	2/2/93	TOTAL DISSOLVED SOLIDS	580.00	14.00	MG/L		V
P206589	GW00524WC	4/16/93	TOTAL DISSOLVED SOLIDS	600.00	10.00	MG/L		
B206589	GW01118WC	8/12/93	TOTAL DISSOLVED SOLIDS	590.00	10.00	MG/L		V
B206589	GW01406WC	11/5/93	TOTAL DISSOLVED SOLIDS	560.00	10.00	MG/L		V
B206589	GW000380A	1/20/94	TOTAL DISSOLVED SOLIDS	560.00	10.00	MG/L		Y
B206689	GW009531T	3/12/91	TOTAL DISSOLVED SOLIDS	592.00	10.00	MG/L		V
B206689	GW015271T	7/16/91	TOTAL DISSOLVED SOLIDS	520.00	10.00	MG/L		
B206689	GW019621T	10/31/91	TOTAL DISSOLVED SOLIDS	510.00	10.00	MG/L		V
B206689	GW023121T	2/22/92	TOTAL DISSOLVED SOLIDS	580.00	10.00	MG/L		V
B206689	GW027221T	4/23/92	TOTAL DISSOLVED SOLIDS	480.00	10.00	MG/L		V
B206689	GW030921T	7/16/92	TOTAL DISSOLVED SOLIDS	500.00	10.00	MG/L		V
B206689	GW036101T	10/6/92	TOTAL DISSOLVED SOLIDS	570.00	14.00	MG/L		V
B206689	GW00119WC	2/11/93	TOTAL DISSOLVED SOLIDS	700.00	10.00	MG/L		V
P206689	GW00525WC	4/21/93	TOTAL DISSOLVED SOLIDS	550.00	14.00	MG/L		V
P206689	GW01119WC	8/10/93	TOTAL DISSOLVED SOLIDS	511.00	14.00	MG/L		V
B206689	GW01407WC	10/18/93	TOTAL DISSOLVED SOLIDS	600.00	14.00	MG/L		V
B206689	GW000400A	1/25/94	TOTAL DISSOLVED SOLIDS	590.00	10.00	MG/L		Y
B206889	GW009511T	3/12/91	TOTAL DISSOLVED SOLIDS	3560.00	10.00	MG/L		JA
B206889	GW00527WC	4/22/93	TOTAL DISSOLVED SOLIDS	3700.00	10.00	MG/L		V
B208089	GW014721T	7/10/91	TOTAL DISSOLVED SOLIDS	700.00	10.00	MG/L		
B208089	GW018201T	10/8/91	TOTAL DISSOLVED SOLIDS	550.00	10.00	MG/L		V
B208089	GW021971T	1/10/92	TOTAL DISSOLVED SOLIDS	610.00	10.00	MG/L		V
B208089	GW026351T	4/10/92	TOTAL DISSOLVED SOLIDS	510.00	10.00	MG/L		V
B208089	GW031331T	7/15/92	TOTAL DISSOLVED SOLIDS	550.00	10.00	MG/L		V
B208089	GW036321T	10/6/92	TOTAL DISSOLVED SOLIDS	620.00	14.00	MG/L		V
B208089	GW00558WC	4/23/93	TOTAL DISSOLVED SOLIDS	600.00	10.00	MG/L		V
B208089	GW01128WC	7/28/93	TOTAL DISSOLVED SOLIDS	680.00	10.00	MG/L		V
B208889	GW022271T	1/14/92	TOTAL DISSOLVED SOLIDS	4800.00	10.00	MG/L		V
B208889	GW026541T	4/10/92	TOTAL DISSOLVED SOLIDS	2800.00	10.00	MG/L		V
B208789	GW022081T	1/14/92	TOTAL DISSOLVED SOLIDS	780.00	10.00	MG/L		V
B208789	GW026381T	4/9/92	TOTAL DISSOLVED SOLIDS	930.00	10.00	MG/L		V
B208789	GW031321T	7/21/92	TOTAL DISSOLVED SOLIDS	1000.00	10.00	MG/L		V
B208789	GW036231T	10/6/92	TOTAL DISSOLVED SOLIDS	930.00	14.00	MG/L		V
B210489	GW015161T	7/15/91	TOTAL DISSOLVED SOLIDS	7600.00	10.00	MG/L		
B210489	GW018831T	10/21/91	TOTAL DISSOLVED SOLIDS	4900.00	10.00	MG/L		V
B210489	GW022281T	1/13/92	TOTAL DISSOLVED SOLIDS	4600.00	10.00	MG/L		V
B210489	GW026551T	4/10/92	TOTAL DISSOLVED SOLIDS	2600.00	10.00	MG/L		V
B210489	GW031851T	7/20/92	TOTAL DISSOLVED SOLIDS	4800.00	10.00	MG/L		V
B210489	GW036391T	10/8/92	TOTAL DISSOLVED SOLIDS	5720.00	10.00	MG/L		V
P210489	GW00144WC	2/2/93	TOTAL DISSOLVED SOLIDS	4600.00	14.00	MG/L		V
B210489	GW00637WC	4/19/93	TOTAL DISSOLVED SOLIDS	4000.00	14.00	MG/L		JA
B210489	GW01131WC	8/4/93	TOTAL DISSOLVED SOLIDS	4516.00	14.00	MG/L		V
B210489	GW01420WC	10/20/93	TOTAL DISSOLVED SOLIDS	4700.00	10.00	MG/L		V
B210489	GW000450A	1/20/94	TOTAL DISSOLVED SOLIDS	4400.00	10.00	MG/L		Y
P209789	GW010251T	3/26/91	TOTAL DISSOLVED SOLIDS	690.00	10.00	MG/L		V

**ROCKY FLATS PLANT OU-6
TOTAL DISSOLVED SOLIDS**

location	fieldid	date sampled	analyte	result	rep_lim	units	qual_lab	qual_wc
P209789	GW01610IT	8/1/91	TOTAL DISSOLVED SOLIDS	660 00	10 00	MG/L		
P209789	GW01837IT	10/11/91	TOTAL DISSOLVED SOLIDS	740 00	10 00	MG/L		V
P209789	GW02239IT	1/20/92	TOTAL DISSOLVED SOLIDS	610 00	10 00	MG/L		V
P209789	GW02789IT	4/24/92	TOTAL DISSOLVED SOLIDS	600 00	10 00	MG/L		V
P209789	GW03186IT	7/20/92	TOTAL DISSOLVED SOLIDS	590 00	10 00	MG/L		V
P209789	GW03551IT	10/16/92	TOTAL DISSOLVED SOLIDS	1030 00	10 00	MG/L		V
P209789	GW00021WC	2/9/93	TOTAL DISSOLVED SOLIDS	950 00	14 00	MG/L		V
P209789	GW00493WC	4/6/93	TOTAL DISSOLVED SOLIDS	1000 00	14 00	MG/L		V
P209789	GW01048WC	7/16/93	TOTAL DISSOLVED SOLIDS	670 00	10 00	MG/L		V
P209789	GW01379WC	10/15/93	TOTAL DISSOLVED SOLIDS	1100 00	10 00	MG/L		V
P218389	GW01522WC	11/16/93	TOTAL DISSOLVED SOLIDS	405 00	14 00	MG/L		V
P219489	GW01523WC	11/16/93	TOTAL DISSOLVED SOLIDS	509 00	14 00	MG/L		V



CHURCH DITCH

Mc KAY DITCH

Mc KAY BYPASS CULVERT
LANDFILL POND
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166.1
166.3
166.2

UNNAMED TRIBUTARY

142.12

Mc KAY DITCH

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TABLE 2 1
PHASE I ANALYTICAL PROGRAM

IHSS	Location	Media	Total U	Total Cr	Be	H3	Nitrate/ Nitrite as N	Gross α	Gross β	U 233/234	U 235	U 238	Pu 239/240	Am 241	Cs 137	Sr 89/90
141	Surface samples on 25 grid	Surface soil	X	X	X		X	X	X	X	X	X	X	X		
	Well downgradient of unit	Groundwater						X	X	X	X	X	X	X		
142	Sediment samples	Sediment	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Dry sediment samples	Sediment	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Water samples	Surface water	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Wells downgradient of A 4 and B-5 including the four Bedrock Wells in North Walnut Creek	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X	X	X
143	Surface samples	Surface soil	X	X	X	X	X	X	X	X	X	X	X	X		
	Core samples on 20 grid	Subsurface soil	X	X	X	X	X	X	X	X	X	X	X	X		
	Well downgradient of unit	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X		
	Surface samples	Surface soil						X	X	X	X	X	X	X		
156	Borings	Subsurface soil						X	X	X	X	X	X	X		
	Well within unit	Groundwater						X	X	X	X	X	X	X		
	Surface samples from transect locations	Surface soil			X			X	X	X	X	X	X	X		
163	Borings to confirm soil gas	Subsurface soil			X			X	X	X	X	X	X	X		
	Borings transecting plumes grabs from 2 intervals 6 composites	Subsurface soil			X			X	X	X	X	X	X	X		
	Wells within the site	Groundwater						X	X							
	Borings along each trench grabs from 2 intervals 6 composites	Subsurface soil						X	X	X	X	X	X	X		
166	Well downgradient of the trenches and the Bedrock Well located in unnamed tributary of North Walnut Creek	Groundwater						X	X							
	Surface and core samples on 100 grid	Surface and Subsurface soil						X	X	X	X	X	X	X		
167	Wells downgradient of units	Groundwater				X	X									
	Surface and core samples	Surface and Subsurface soil				X		X	X	X	X	X	X	X		
216																

TABLE 2 1
(continued)

IHSS	Location	Media	TAL Metals/ Additional Metals	TOC	TCL VOCs	TCL SVOCs	TCL Pesticides/ PCBs	WQPL	Filtered										Additional Parameters for IHSS 142 1 9 & 12 Water Samples	Aquatic Toxicity
									U 233/ 234	U 235	U 238	Pu 239/240	Cs 137	Sr 89/90	Am 241	TAL Metals				
141	Surface samples on 25 grid	Surface soil	X				X													
142	Well downgradient of unit	Groundwater	X		X	X														
	Sediment samples	Sediment	X	X	X	X														
	Dry sediment samples	Sediment	X		X	X														
	Water samples	Surface water	X		X	X		X	X	X	X	X	X	X	X	X				
	Wells downgradient of A 4 and B-5 including the four Bedrock Wells in North Walnut Creek	Groundwater	X		X	X		X	X	X	X	X	X	X	X	X			X	
143	Surface samples	Surface soil	X	X	X	X														
156	Core samples on 20 grid	Subsurface soil	X	X	X	X														
	Well downgradient of unit	Groundwater	X	X	X	X														
	Surface samples	Surface soil	X	X	X	X														
	Borings	Subsurface soil	X																	
	Well within unit	Groundwater	X																	
165	Surface samples from transect locations	Surface soil	X	X				X	X	X	X	X	X	X	X					
166	Borings to confirm soil gas	Subsurface soil			X	X														
	Borings transecting plumes grabs from 2 intervals 6 composites	Subsurface soil	X		X	X														
	Wells within the site	Groundwater	X		X	X	X													
	Borings along each trench grabs from 2 intervals 6 composites	Subsurface soil	X		X															
	Well downgradient of the trenches and the Bedrock Well located in unnamed tributary of North Walnut Creek	Groundwater	X		X	X	X													
167	Surface and core samples on 100 grid	Surface and Subsurface soil	X	X																
216	Wells downgradient of units	Groundwater	X		X		X													
	Surface and core samples	Surface and Subsurface soil	X	X																

TABLE 2 1
(continued)

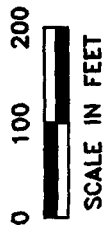
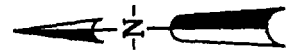
IHSS	Event	Media	H3	Gross α	Gross β	U 233/234	U 235	U 238	Pu 239/240	Am 241	Cs 137	Sr 89/90	Filtered			
													UISO	Pu 239/240	Cs 137	Sr 89/90
N/A	Stream Base Flow Sampling	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	X	
N/A	Stream Storm Event Sampling	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	X	
N/A	Stream	Sediments	X	X	X	X	X	X	X	X	X	X				

TABLE 2 1
(concluded)

IHSS	Event	Media	GFAA Metals	TAL Metals	TCL VOCs	TCL SVOCs	Pest/ PCBs	TOC	WQPL	NH as NH ₃	Hardness	Nitrate/Nitrate as N	Filtered	
													Acute Toxicity	Micro Toxicity
N/A	Stream Base Flow Sampling	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X
N/A	Stream Storm Event Sampling	Surface Water	X	X	X	X	X	X	X	X	X	X		X
N/A	Stream	Sediments		X	X	X	X	X				X		

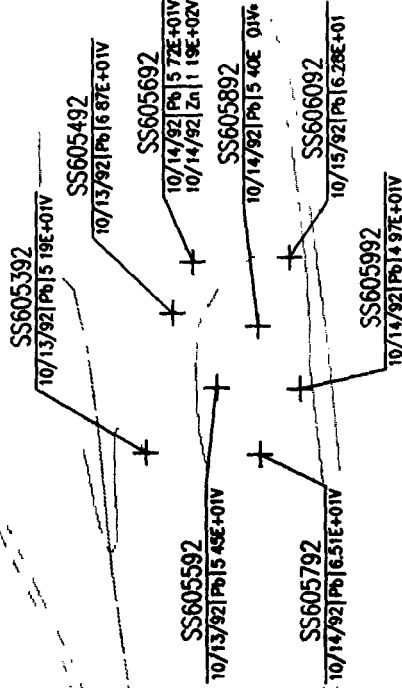
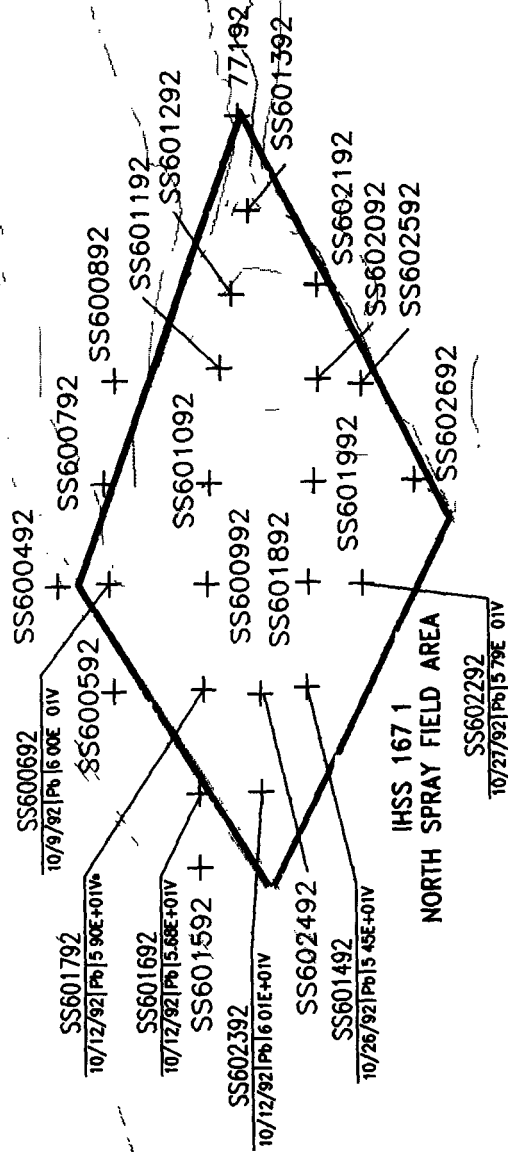
* Six randomly chosen surface soil samples will be analyzed for TCL pesticides/PCBs

α = Alpha
β = Beta
Am = Americium
Be = Beryllium
Cr = Chromium
Cs = Cesium
H3 = Tritium
N = Nitrogen
Pu = Plutonium
Sr = Strontium
SVOCs = Semivolatile Organic Compounds
TAL = Target Analyte List
TCL = Target Compound List
TDS = Total Dissolved Solids
TOC = Total Organic Carbon
U = Uranium
VOCs = Volatile Organic Compounds
UIISO = Uranium Isotopes
GFAA = Graphite Furnace Atomic Absorption
WQPL = Water Quality Parameters List
NH₄⁺ = Ammonium ion as NH₃
PCBs = Polychlorinated Biphenyls



Mc KAY BYPASS CANAL

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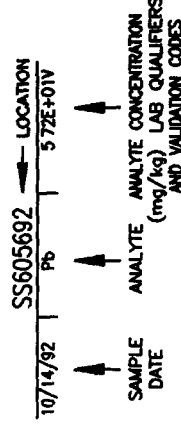


EXPLANATION



INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

+ SURFACE SOIL SAMPLE SITE
SS602592



SS605692
10/14/92
Pb

SAMPLE
DATE

ANALYTE

ANALYTE CONCENTRATION
(mg/kg) LAB QUALIFIERS
AND VALIDATION CODES

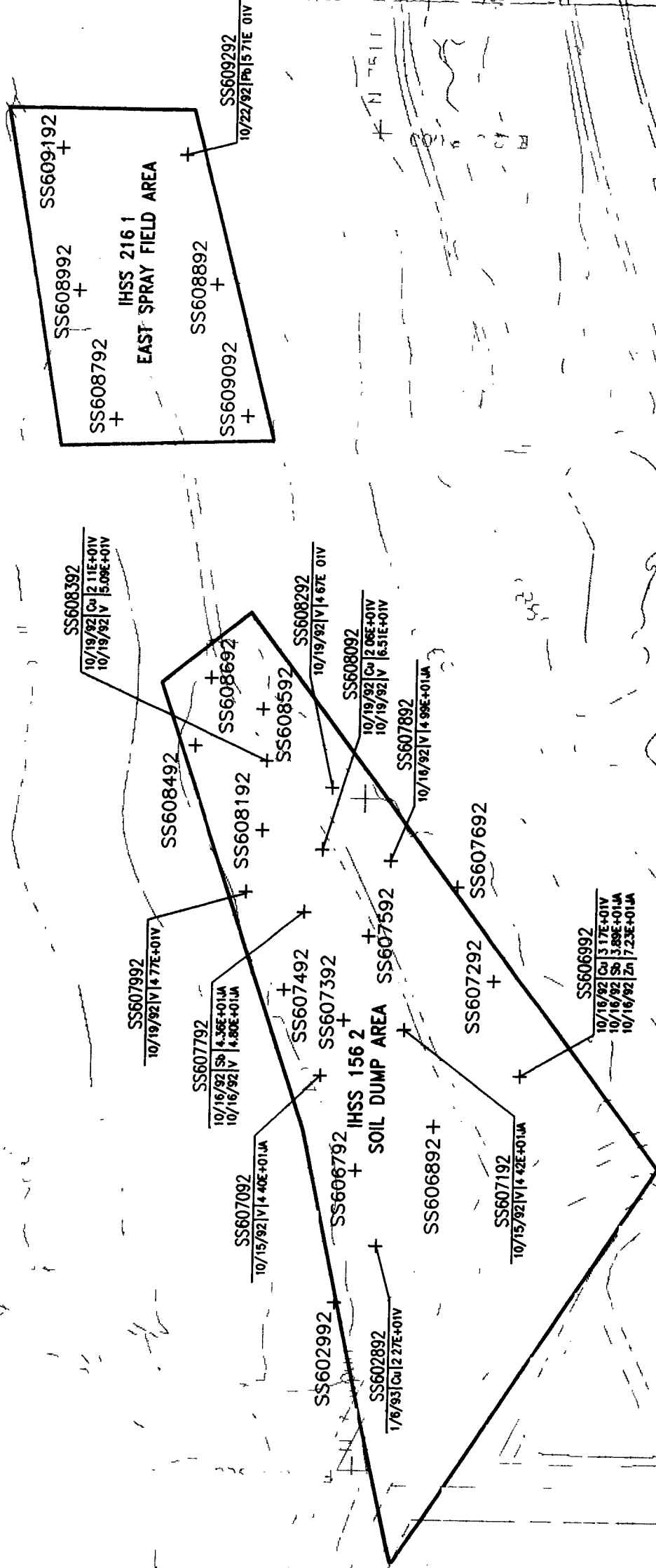
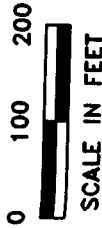
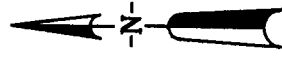
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN mg/kg (parts per million)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

ANTIMONY COPPER LEAD
SILVER VANADIUM AND ZINC
(IHSS 167 1)
SURFACE SOILS

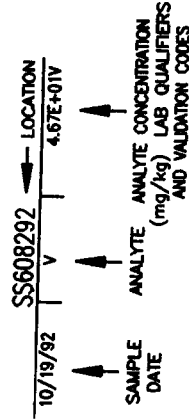


EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



+ SURFACE SOIL SAMPLE SITE
SS602992



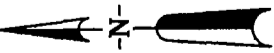
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN mg/kg (parts per million)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS.

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

ANTIMONY COPPER LEAD
SILVER VANADIUM AND ZINC
(IHSSs 156 2 & 216 1)
SURFACE SOILS



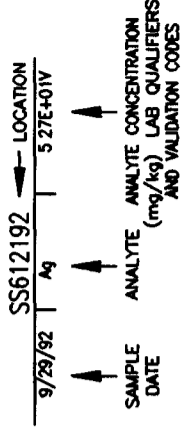
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SCALE IN FEET

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



+ SURFACE SOIL SAMPLE SITE
SS612192



NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN mg/kg (parts per million)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS
- * INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

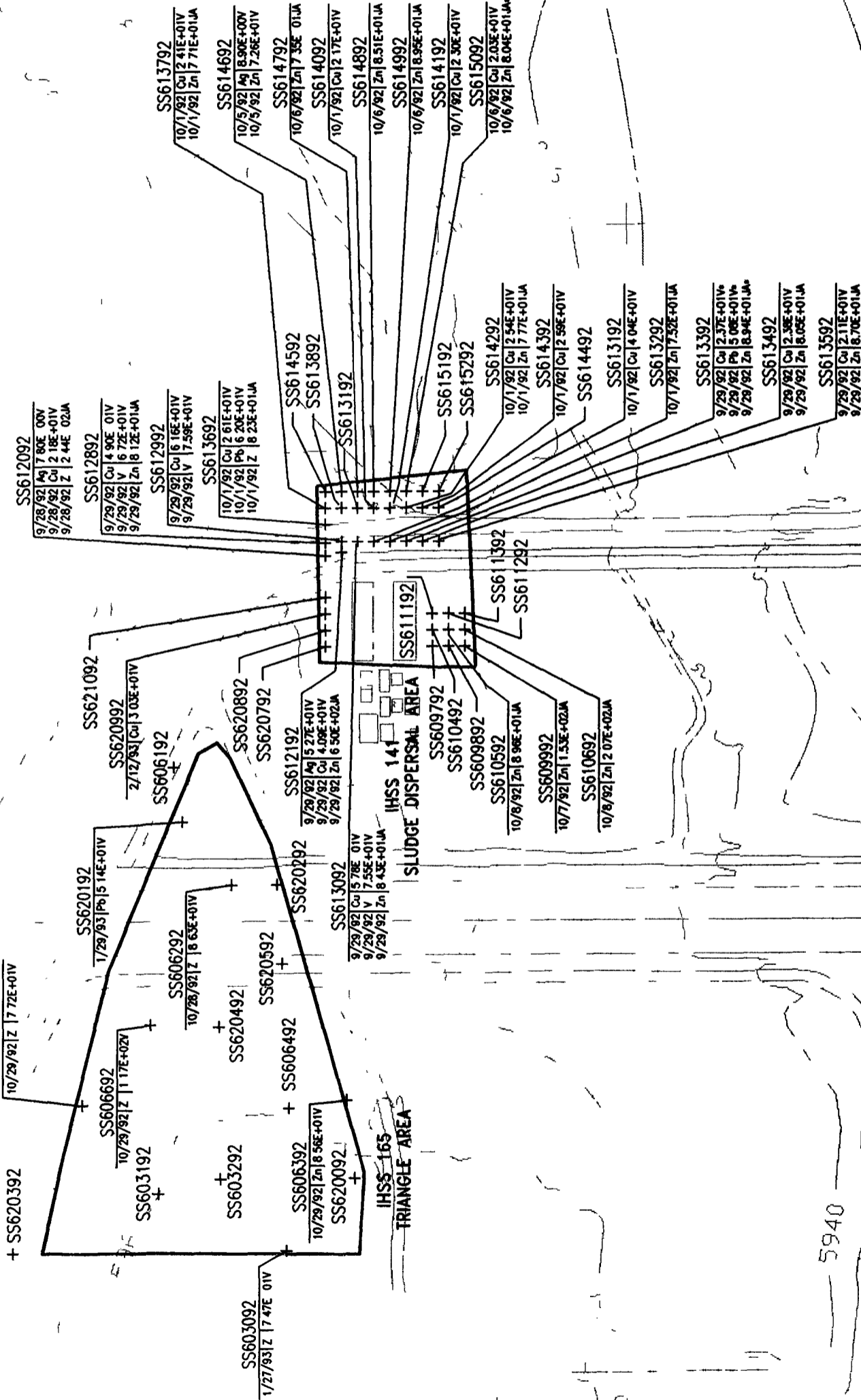
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

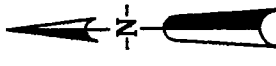
ANTIMONY COPPER LEAD
SILVER VANADIUM AND ZINC
(IHSSs 141 & 165)
SURFACE SOILS

FIGURE 3-3

AUGUST 1994

OU6TM033 1-200

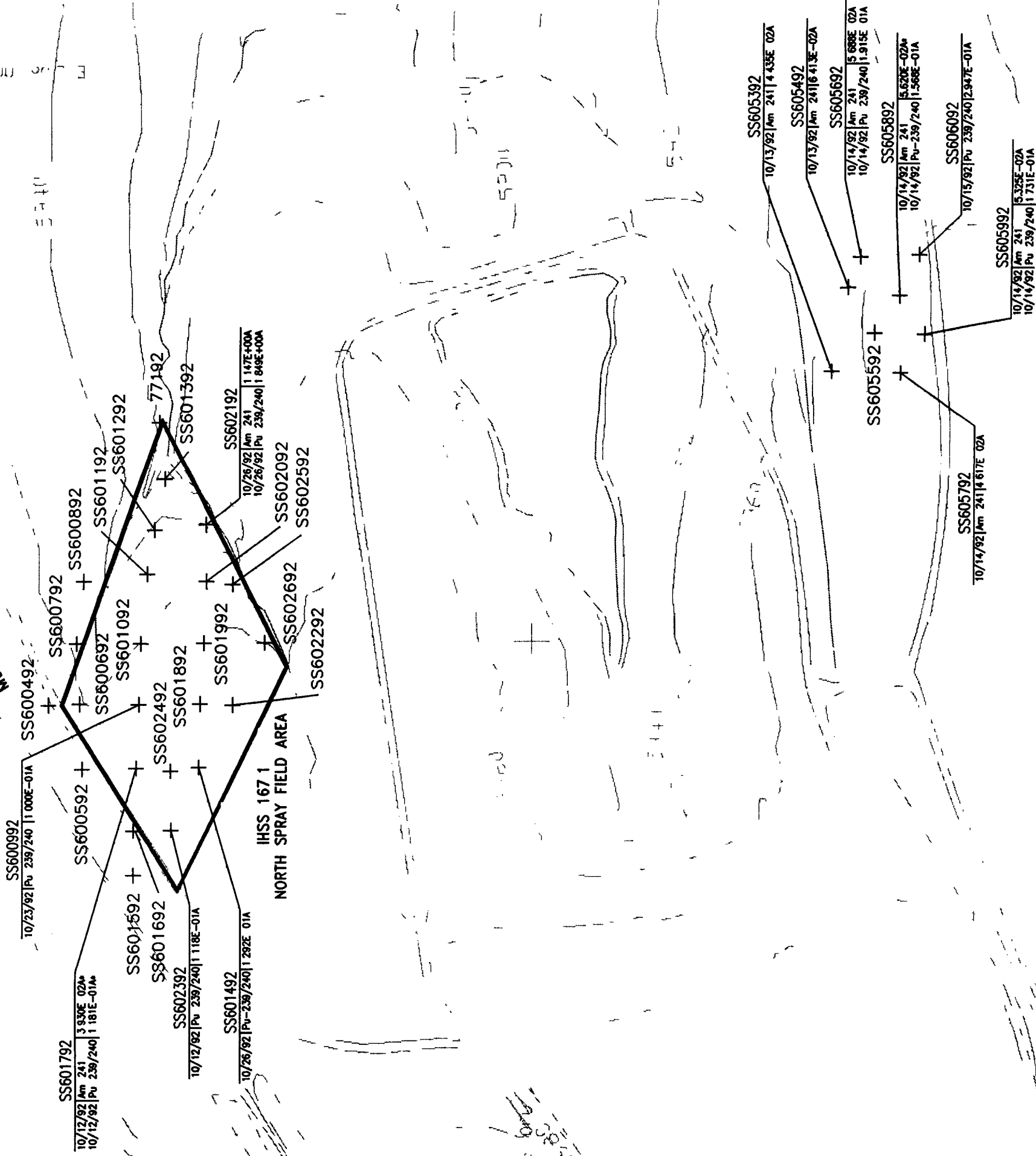




MC KAY BYPASS CANAL

MC KAY DITCH

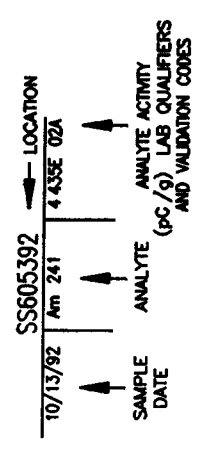
IHSS 167 1
NORTH SPRAY FIELD AREA



EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

+ SURFACE SOIL SAMPLE SITE
SS602592



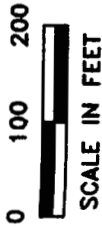
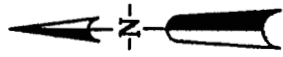
NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/g
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AMERICIUM-241 AND PLUTINIUM-239/240
(IHSS 167 1)
SURFACE SOILS

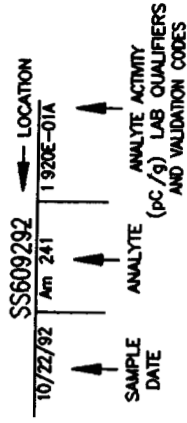


EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



+ SURFACE SOIL SAMPLE SITE
SS602992



NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/g
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AMERICIUM-241 AND PLUTONIUM-239/240
(IHSS 156 2 AND 216 1)
SURFACE SOILS

FIGURE 3-5

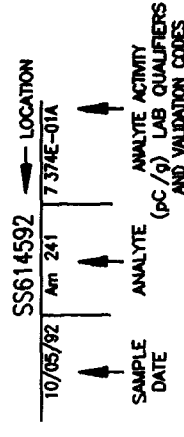
AUGUST 1994

OUT1M035 1 200

EXPLANATION

INDIVIDUAL HAZARDOUS SUBSTANCE SITES

SS612192 + SURFACE SOIL SAMPLE SITE



NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/g
2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED RESULTS ARE SHOWN ONLY WHERE THE
CHEMICALS WERE DETECTED ABOVE BACKGROUND
MEAN PLUS 2 STANDARD DEVIATIONS
INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AMERICIUM-241 AND PLUTONIUM-239/240
(IHSSs 141 AND 165)
SURFACE SOILS

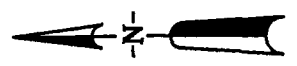
FIGURE 3-6

AUGUST 1994

44-874

OU6TM036 1 200

MC KAY BRASS CANAL



0 100 200
SCALE IN FEET

- EXPLANATION
- INDIVIDUAL HAZARDOUS SUBSTANCE SITES
 - BOREHOLE
 - MONITORING WELL (ALLUVIAL)

68092 ← LOCATION
15 17 METHYLENE CHLORIDE (V) 5.0E+008UA
↑ SAMPLE ANALYTE ANALYTE CONCENTRATION
INTERVAL (R) (ug/kg) AND LAB QUALIFIERS
AND VALIDATION CODES
(V) - VOLATILE

- NOTES
- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORINE
(IHSSs 166.1 AND 166.2)
SUBSURFACE SOILS

67192

09 11	METHYLENE CHLORIDE	(V) 5.0E+008UA
38-4	METHYLENE CHLORIDE	(V) 5.0E+008UA
56-58	METHYLENE CHLORIDE	(V) 5.0E+008UA
74 76	METHYLENE CHLORIDE	(V) 5.0E+008UA
92 94	METHYLENE CHLORIDE	(V) 7.0E+008UA
12 122	METHYLENE CHLORIDE	(V) 6.0E+008UA

67292

11 13	METHYLENE CHLORIDE	(V) 6.0E+008UA
31 33	METHYLENE CHLORIDE	(V) 7.0E+008UA
58 6	METHYLENE CHLORIDE	(V) 7.0E+008UA
71 73	METHYLENE CHLORIDE	(V) 6.0E+008UA
95 97	METHYLENE CHLORIDE	(V) 8.0E+008UA
118 12	METHYLENE CHLORIDE	(V) 8.0E+008UA

67392

1 12	METHYLENE CHLORIDE	(V) 6.0E+008UA
31 33	METHYLENE CHLORIDE	(V) 6.0E+008UA
47-49	METHYLENE CHLORIDE	(V) 6.0E+008UA
74 76	METHYLENE CHLORIDE	(V) 6.0E+008UA
92 95	METHYLENE CHLORIDE	(V) 6.0E+008UA
113-115	METHYLENE CHLORIDE	(V) 6.0E+008UA

67492

07-09	METHYLENE CHLORIDE	(V) 5.2E+018UA
37 39	METHYLENE CHLORIDE	(V) 6.0E+008UA
51 53	METHYLENE CHLORIDE	(V) 5.0E+008UA
76-78	METHYLENE CHLORIDE	(V) 6.0E+008UA
119 121	METHYLENE CHLORIDE	(V) 6.0E+008UA

68192

08-11	METHYLENE CHLORIDE	(V) 6.0E+008UA
31 34	METHYLENE CHLORIDE	(V) 5.0E+008UA
57-6	METHYLENE CHLORIDE	(V) 5.0E+008UA
67-7	METHYLENE CHLORIDE	(V) 5.5E+008UA
99-102	METHYLENE CHLORIDE	(V) 6.0E+008UA
119 121	METHYLENE CHLORIDE	(V) 6.0E+008UA

68092

15 17	METHYLENE CHLORIDE	(V) 5.0E+008UA
32 34	METHYLENE CHLORIDE	(V) 8.0E+008UA
63-65	METHYLENE CHLORIDE	(V) 12.1E+018UA
10-102	METHYLENE CHLORIDE	(V) 5.7E+018UA
119-121	METHYLENE CHLORIDE	(V) 5.2E+018UA

67892

11 13	METHYLENE CHLORIDE	(V) 11.0E+018UA
35-37	METHYLENE CHLORIDE	(V) 5.0E+008UA
45 48	METHYLENE CHLORIDE	(V) 6.0E+008UA
73 75	METHYLENE CHLORIDE	(V) 5.4E+018V
99 101	METHYLENE CHLORIDE	(V) 8.0E+008UA
114 116	METHYLENE CHLORIDE	(V) 7.0E+008UA

67092

14 16	METHYLENE CHLORIDE	(V) 6.0E+008UA
34 36	METHYLENE CHLORIDE	(V) 6.0E+008UA
58-6	METHYLENE CHLORIDE	(V) 5.0E+008UA
84-86	METHYLENE CHLORIDE	(V) 6.0E+008UA

66992

09 11	METHYLENE CHLORIDE	(V) 6.0E+008UA
58-6	METHYLENE CHLORIDE	(V) 5.0E+008UA
73 75	METHYLENE CHLORIDE	(V) 5.0E+008UA
109 111	METHYLENE CHLORIDE	(V) 6.0E+008UA

66892

12 14	METHYLENE CHLORIDE	(V) 6.0E+008UA
22 24	METHYLENE CHLORIDE	(V) 6.0E+008UA
6-62	METHYLENE CHLORIDE	(V) 6.0E+008UA
77 79	METHYLENE CHLORIDE	(V) 5.0E+008UA
101 103	METHYLENE CHLORIDE	(V) 6.0E+008UA
121 123	METHYLENE CHLORIDE	(V) 6.0E+008UA

68292

07 09	METHYLENE CHLORIDE	(V) 6.0E+008UA
34 36	METHYLENE CHLORIDE	(V) 5.0E+008UA
53-55	METHYLENE CHLORIDE	(V) 5.0E+008UA
82 85	METHYLENE CHLORIDE	(V) 6.0E+008UA
119 121	METHYLENE CHLORIDE	(V) 6.0E+008UA

67992

11 13	METHYLENE CHLORIDE	(V) 1.9E+018UA
3 32	METHYLENE CHLORIDE	(V) 5.0E+008UA
53 55	METHYLENE CHLORIDE	(V) 1.3E+018UA
76 78	METHYLENE CHLORIDE	(V) 1.4E+018UA
97 99	METHYLENE CHLORIDE	(V) 1.5E+018UA

67592

14-16	METHYLENE CHLORIDE	(V) 3.7E+038UA
31 33	METHYLENE CHLORIDE	(V) 3.4E+038UA
44-46	METHYLENE CHLORIDE	(V) 3.5E+038UA
78-8	METHYLENE CHLORIDE	(V) 3.7E+038UA
101 103	METHYLENE CHLORIDE	(V) 3.7E+038UA
12 122	METHYLENE CHLORIDE	(V) 3.7E+038UA

67692

13-15	METHYLENE CHLORIDE	(V) 3.1E+038UA
24-26	METHYLENE CHLORIDE	(V) 3.0E+018UA
58-59	METHYLENE CHLORIDE	(V) 1.9E+018UA
65-67	METHYLENE CHLORIDE	(V) 6.0E+008UA
10 102	METHYLENE CHLORIDE	(V) 7.0E+008UA
117 119	METHYLENE CHLORIDE	(V) 6.0E+008UA

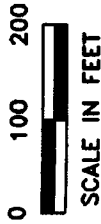
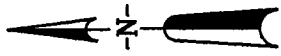
67792

14-16	METHYLENE CHLORIDE	(V) 6.0E+008UA
29 31	METHYLENE CHLORIDE	(V) 7.0E+008UA
42-44	METHYLENE CHLORIDE	(V) 1.9E+018UA
62 64	METHYLENE CHLORIDE	(V) 8.0E+008UA
99 101	METHYLENE CHLORIDE	(V) 6.0E+008UA
119 121	METHYLENE CHLORIDE	(V) 1.2E+018UA

LANDFILL POND

IHSS 166.1
TRENCH A

IHSS 166.2
TRENCH B

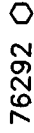


NO KN BRASS CANN

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



BOREHOLE



MONITORING WELL
(ALLUVIAL)



69292

06 08 METHYLENE CHLORIDE (V) 6.0E+008UA
72 74 METHYLENE CHLORIDE (V) 5.0E+008UA
98 10 METHYLENE CHLORIDE (V) 6.0E+008UA
117 119 METHYLENE CHLORIDE (V) 6.0E+008UA

69192

03-05 METHYLENE CHLORIDE (V) 3.0E+018UA
38-4 METHYLENE CHLORIDE (V) 5.0E+008UA
5 52 METHYLENE CHLORIDE (V) 5.0E+008UA
88 9 METHYLENE CHLORIDE (V) 6.0E+008UA
119 12 METHYLENE CHLORIDE (V) 6.0E+008UA

69092

05-07 METHYLENE CHLORIDE (V) 3.0E+018UA
25-27 METHYLENE CHLORIDE (V) 6.0E+008UA
45-47 METHYLENE CHLORIDE (V) 6.0E+008UA
71 73 METHYLENE CHLORIDE (V) 6.0E+008UA
116-118 METHYLENE CHLORIDE (V) 6.0E+008UA

68992

03-05 METHYLENE CHLORIDE (V) 6.0E+008UA
31 33 METHYLENE CHLORIDE (V) 6.5E+008UA
45 47 METHYLENE CHLORIDE (V) 8.0E+008UA
98 10 METHYLENE CHLORIDE (V) 6.0E+008UA

IHSS 166 3
TRENCH C

68392

06-08 METHYLENE CHLORIDE (V) 6.0E+008UA
32 35 METHYLENE CHLORIDE (V) 6.0E+008UA
53-55 METHYLENE CHLORIDE (V) 6.0E+008UA
77 79 METHYLENE CHLORIDE (V) 6.0E+008UA
86-88 METHYLENE CHLORIDE (V) 6.0E+008UA
121 123 METHYLENE CHLORIDE (V) 6.0E+008UA

68492

09 11 METHYLENE CHLORIDE (V) 6.0E+008UA
35 37 METHYLENE CHLORIDE (V) 5.0E+008UA
51 53 METHYLENE CHLORIDE (V) 6.0E+008UA
77 79 METHYLENE CHLORIDE (V) 6.0E+008UA
97 99 METHYLENE CHLORIDE (V) 6.0E+008UA
119-121 METHYLENE CHLORIDE (V) 6.0E+008UA

68592

08 1 METHYLENE CHLORIDE (V) 5.0E+008UA
28-3 METHYLENE CHLORIDE (V) 5.0E+008UA
56-58 METHYLENE CHLORIDE (V) 6.0E+008UA
66-68 METHYLENE CHLORIDE (V) 6.0E+008UA
98-10 METHYLENE CHLORIDE (V) 6.0E+008UA
118 12 METHYLENE CHLORIDE (V) 6.0E+008UA

LANDFILL
POND

69392

06-08 METHYLENE CHLORIDE (V) 8.0E+008UA
32 34 METHYLENE CHLORIDE (V) 8.0E+008UA
5 52 METHYLENE CHLORIDE (V) 8.0E+008UA
58 6 METHYLENE CHLORIDE (V) 1.2E+018UA
72 74 METHYLENE CHLORIDE (V) 8.0E+008UA
84 86 METHYLENE CHLORIDE (V) 8.5E+008UA
12 122 METHYLENE CHLORIDE (V) 9.0E+008UA

76992

IHSS 166.3
TRENCH C

68892

09 11 METHYLENE CHLORIDE (V) 6.5E+008UA
34 36 METHYLENE CHLORIDE (V) 5.0E+008UA
46 48 METHYLENE CHLORIDE (V) 6.0E+008UA
75 77 METHYLENE CHLORIDE (V) 6.0E+008UA
98 10 METHYLENE CHLORIDE (V) 6.0E+008UA
118 12 METHYLENE CHLORIDE (V) 6.0E+008UA

68792

09 11 METHYLENE CHLORIDE (V) 6.0E+008UA
24 26 METHYLENE CHLORIDE (V) 7.0E+008UA
98 10 METHYLENE CHLORIDE (V) 6.0E+008UA
12 122 METHYLENE CHLORIDE (V) 6.0E+008UA

68692

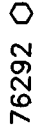
32 34 METHYLENE CHLORIDE (V) 9.0E+008UA
56 58 METHYLENE CHLORIDE (V) 8.0E+008UA
97 99 METHYLENE CHLORIDE (V) 6.0E+008UA

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



BOREHOLE



MONITORING WELL
(ALLUVIAL)



68892

09 11 METHYLENE CHLORIDE (V) 6.5E+008UA

↑ SAMPLE
INTERVAL
(ft)

↑ ANALYTE
CONCENTRATION
(ug/kg) AND LAB QUALIFIERS
AND VALIDATION CODES

(V) - VOLATILE

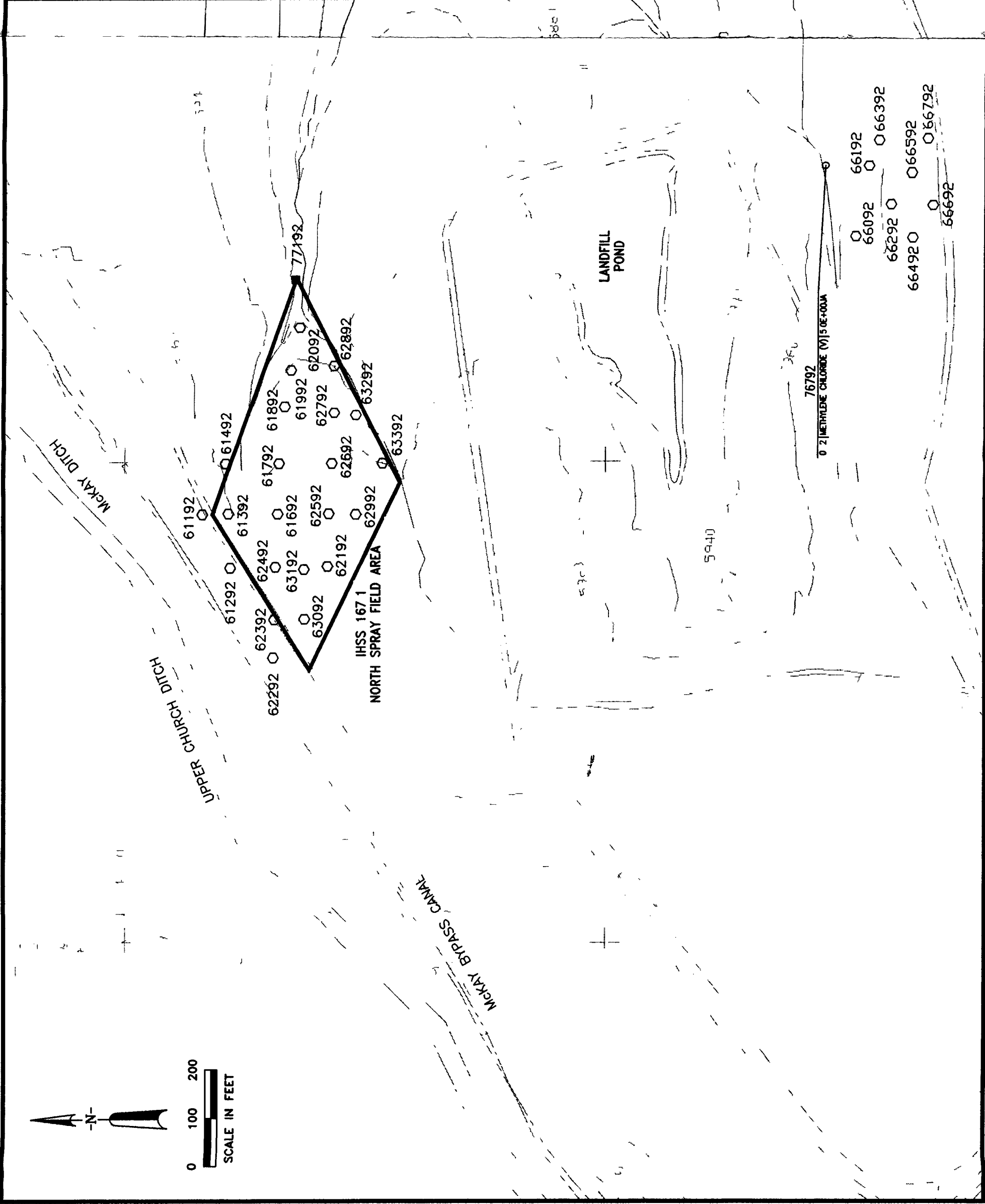
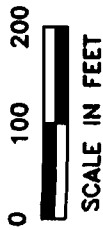
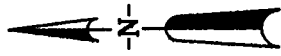
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED
IN ug/kg (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED. RESULTS ARE SHOWN ONLY WHERE
THE CHEMICALS WERE DETECTED
- INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
(IHSS 166 3)
SUBSURFACE SOILS



EXPLANATION

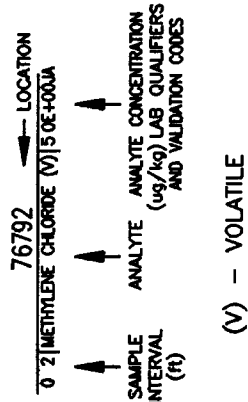
INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



62892 ○ BOREHOLE

77192 ■ MONITORING WELL
(COLLUVIAL)

76792 ○ MONITORING WELL
(ALLUVIAL)



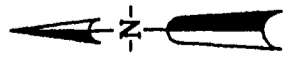
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
(IHSSs 167.1)
SUBSURFACE SOILS



0 100 200

SCALE IN FEET

A-2

5820

5810

5800

5790

IHSS 216-1
EAST SPRAY FIELD AREA

78092

11 1.3 METHYLENE CHLORIDE (V) 3.5E+03BUA

78292

14 1.6 METHYLENE CHLORIDE (V) 3.5E+03BUA

78492

14 1.6 METHYLENE CHLORIDE (V) 3.5E+03BUA

78592

14 1.6 METHYLENE CHLORIDE (V) 3.5E+03BUA

78192

14 1.6 METHYLENE CHLORIDE (V) 3.5E+03BUA

78392

14 1.6 METHYLENE CHLORIDE (V) 2.5E+01BUA

B-3

B-2

B-1

B-4

SOUTH WALNUT CREEK

EXPLANATION



INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

78492 ○

BOREHOLE

78492 ← LOCATION

14 1.6 METHYLENE CHLORIDE (V) 3.5E+03BUA



SAMPLE
INTERVAL
(ft)

ANALYTE ANALYTE CONCENTRATION
(ug/kg) AND LAB QUALIFIERS
AND VALIDATION CODES

(V) - VOLATILE

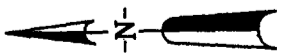
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
(IHSS 216 1)
SUBSURFACE SOILS



0 100 200

SCALE IN FEET

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



74092 ○ BOREHOLE

75892 ○ MONITORING WELL
(ALLUVIAL)

77592 ← LOCATION
T 1.2 | METHYLENE CHLORIDE (V) | 6.0E+008UA

↑ SAMPLE
INTERVAL
(ft) ↑ ANALYTE
ANALYTE CONCENTRATION
(g/kg) LAB QUALIFIERS
AND VALIDATION CODES

(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

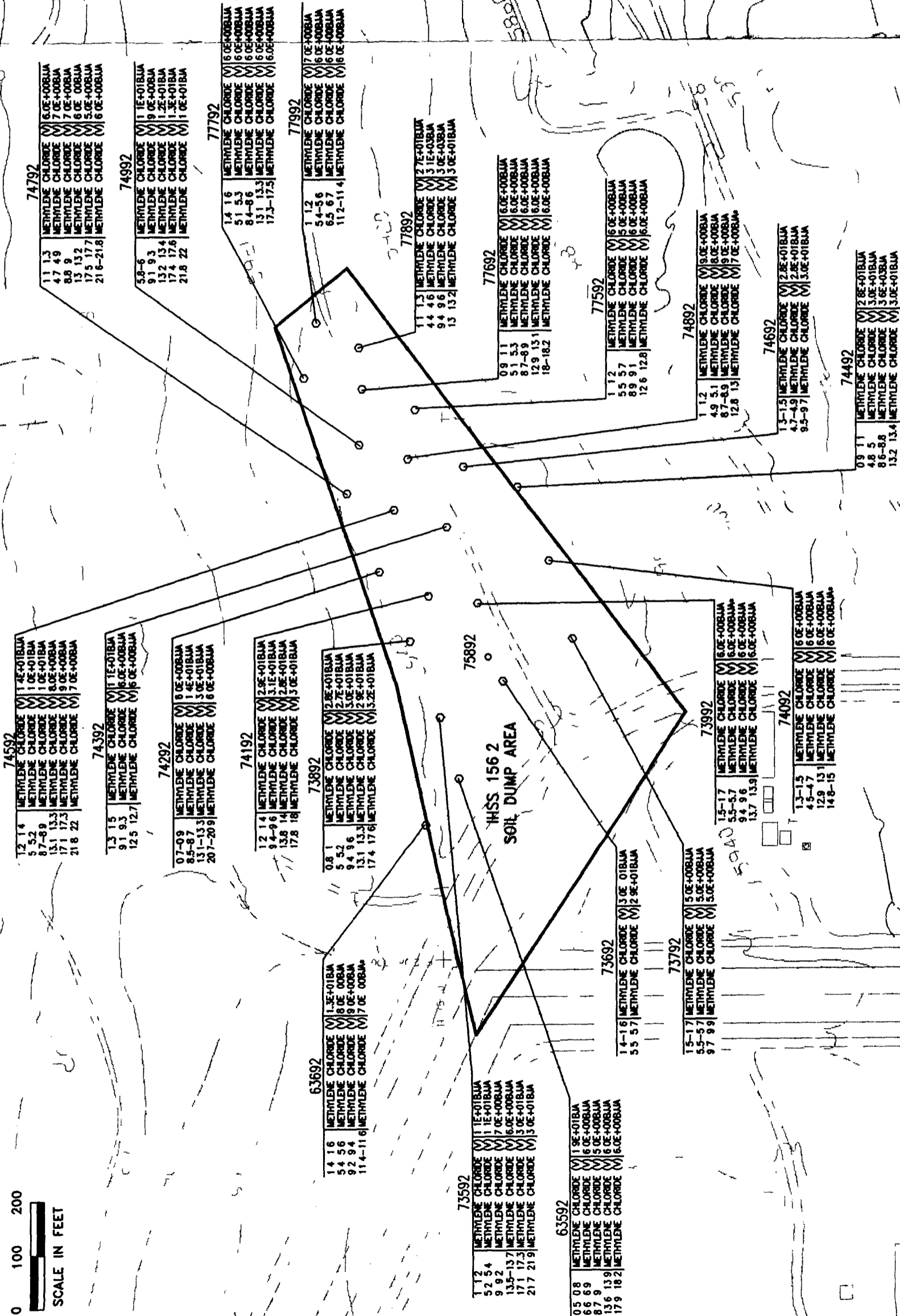
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

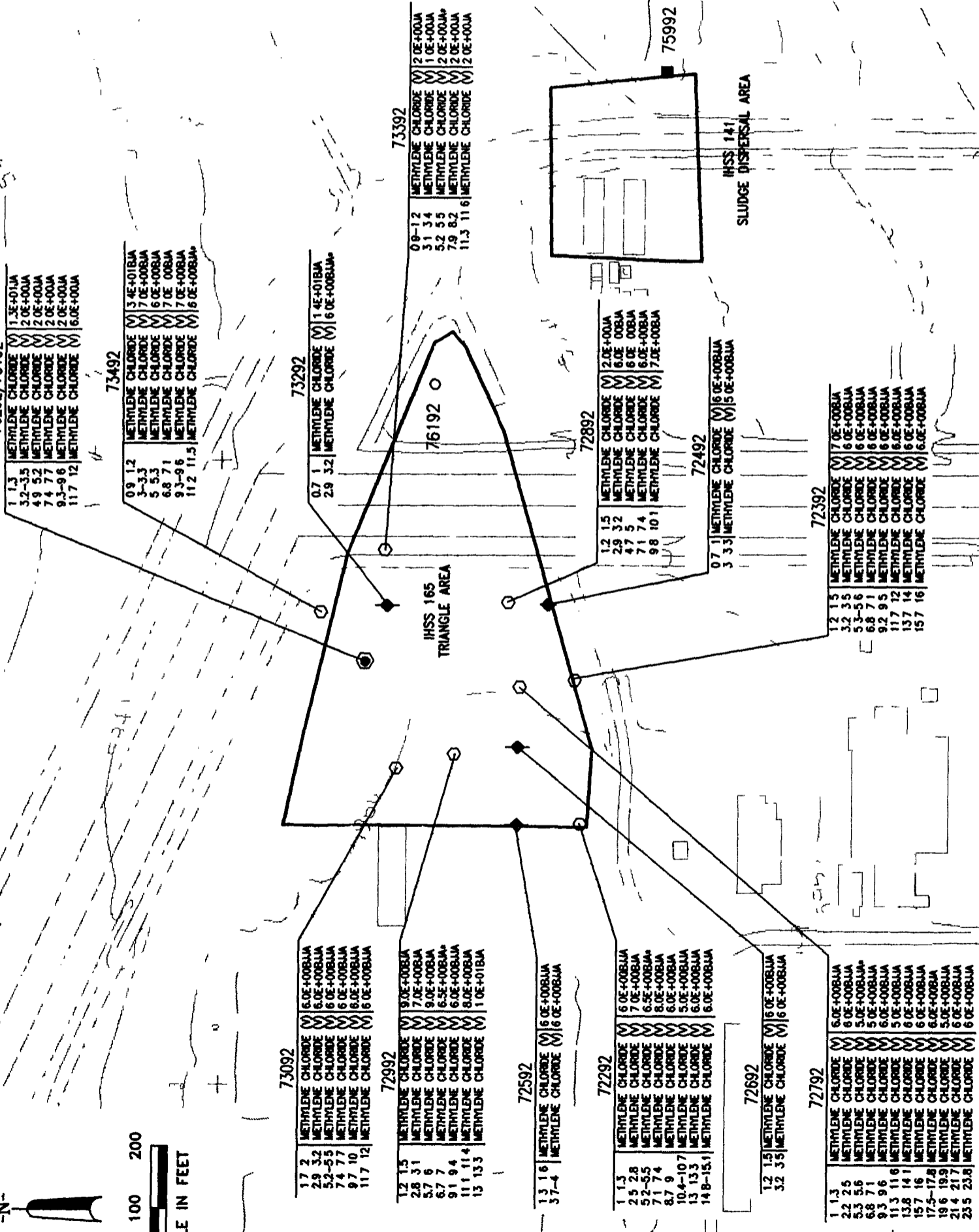
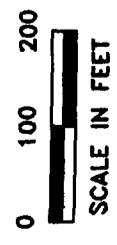
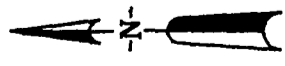
METHYLENE CHLORIDE
(IHSS 156 2)
SUBSURFACE SOILS

FIGURE 4-4

AUGUST 1994

OU61M044 1 200





EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITES
- BOREHOLE
- MONITORING WELL (BEDROCK)
- MONITORING WELL (COLLUVIAL)
- MONITORING WELL (ALLUVIAL)
- SOIL CORE

73392 ← LOCATION

↑ SAMPLE INTERVAL (ft)

↑ ANALYTE ANALYTE CONCENTRATION (ug/kg) LAB QUALIFIERS AND VALIDATION CODES

(V) - VOLATILE

NOTES

1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)

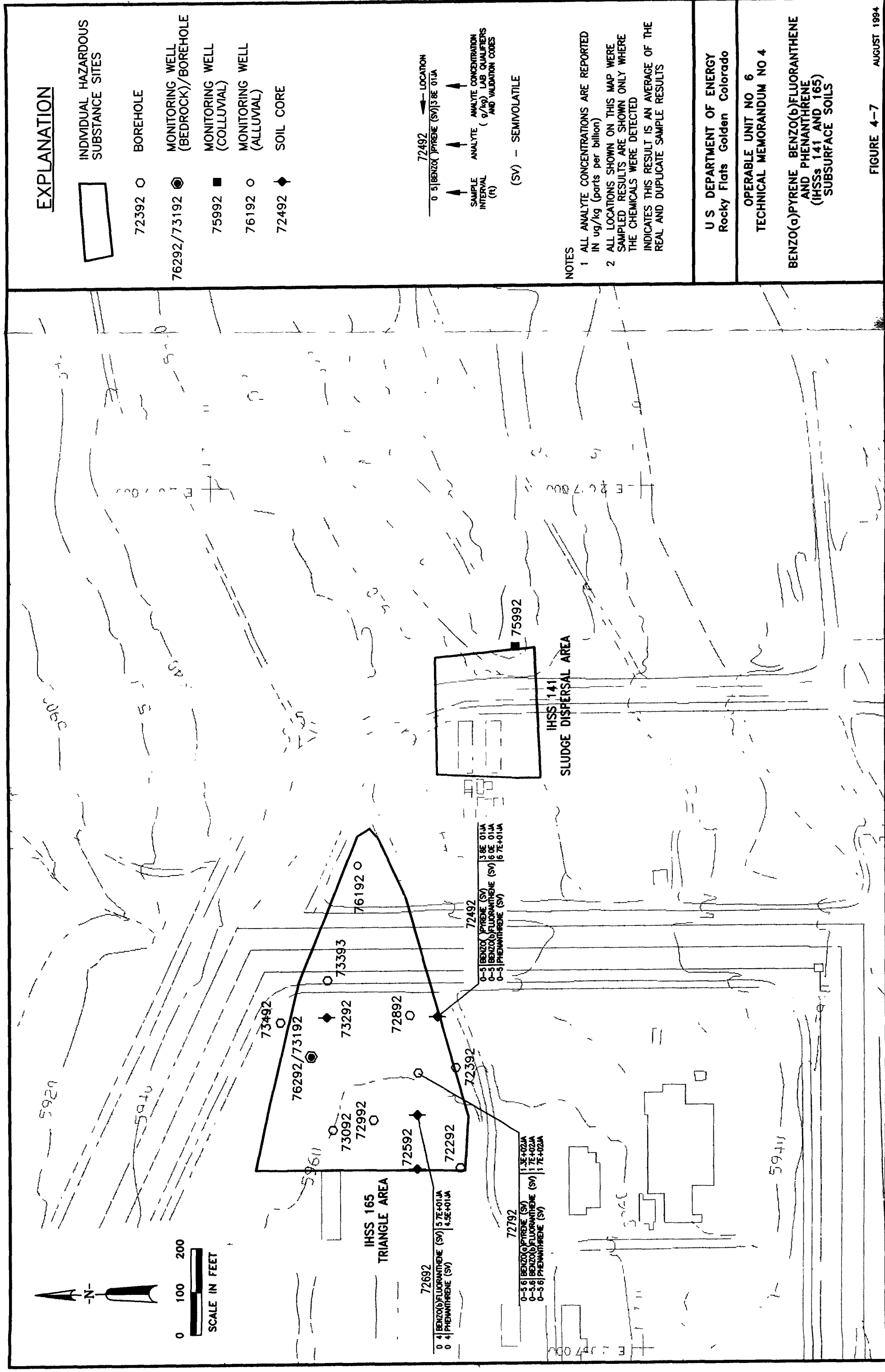
2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED

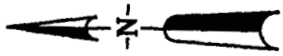
INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
(IHSSs 141 AND 165)
SUBSURFACE SOILS





0 100 200
SCALE IN FEET

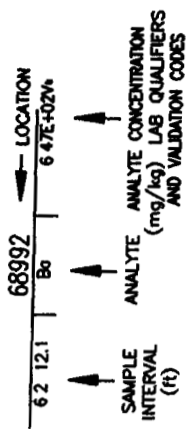
EXPLANATION



INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



68692 ○ BOREHOLE



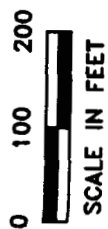
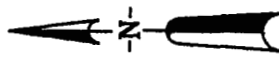
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN mg/kg (parts per million)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U.S. DEPARTMENT OF ENERGY
Rocky Flats, Golden, Colorado

OPERABLE UNIT NO. 6
TECHNICAL MEMORANDUM NO. 4

BARIUM
(IHSSs 166.1 - 166.3)
SUBSURFACE SOILS



Mc KAY DITCH

Mc KAY BRASS CANAL

61392

61192

61492

61292

62992

62292

62492

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63192

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62392

61792

61892

62792

62892

63292

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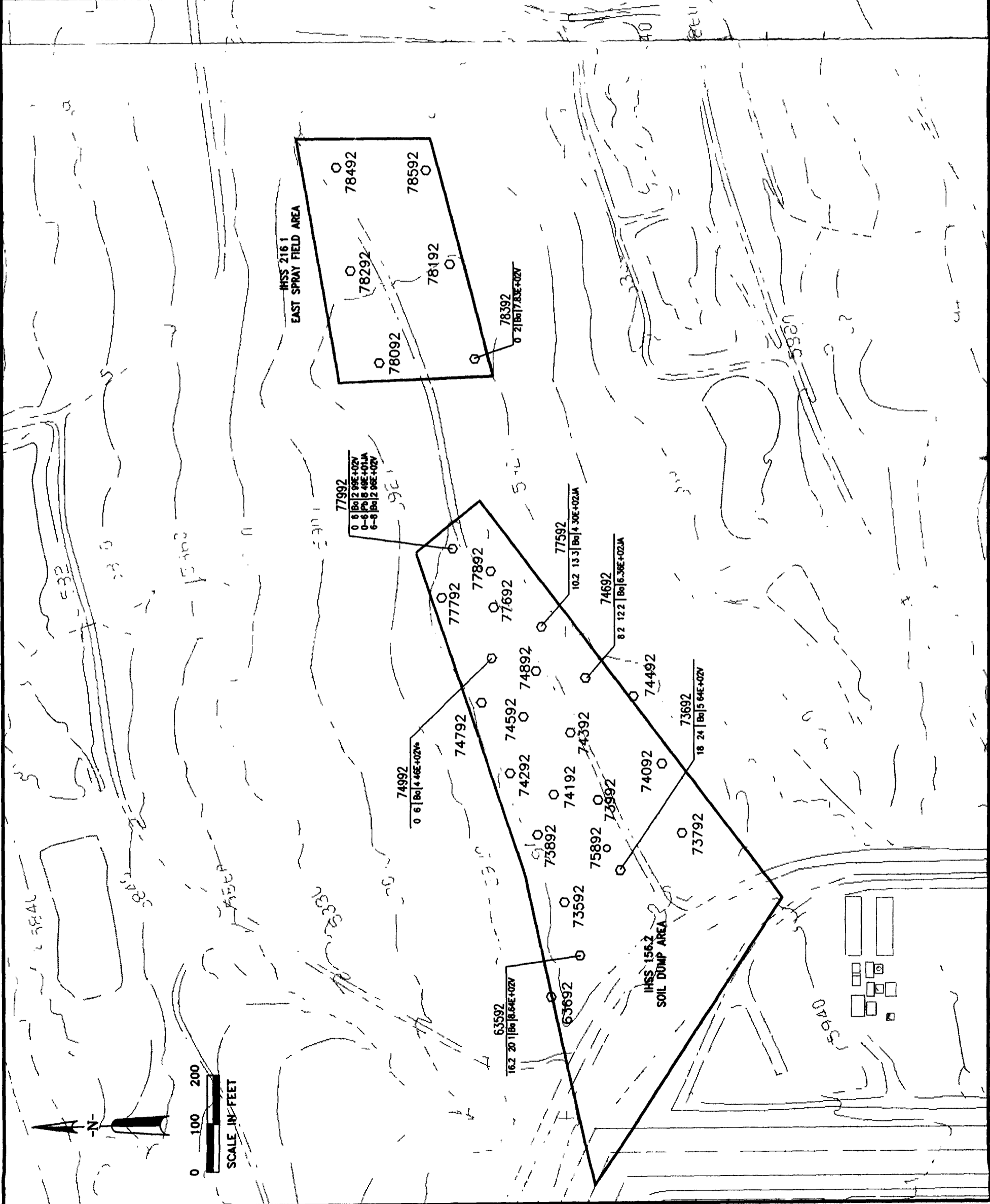
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63392

62892

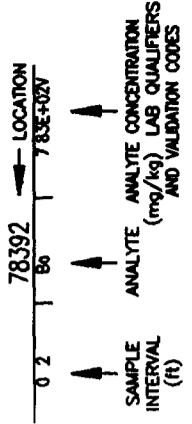


EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

BOREHOLE

MONITORING WELL
(ALLUVIAL)

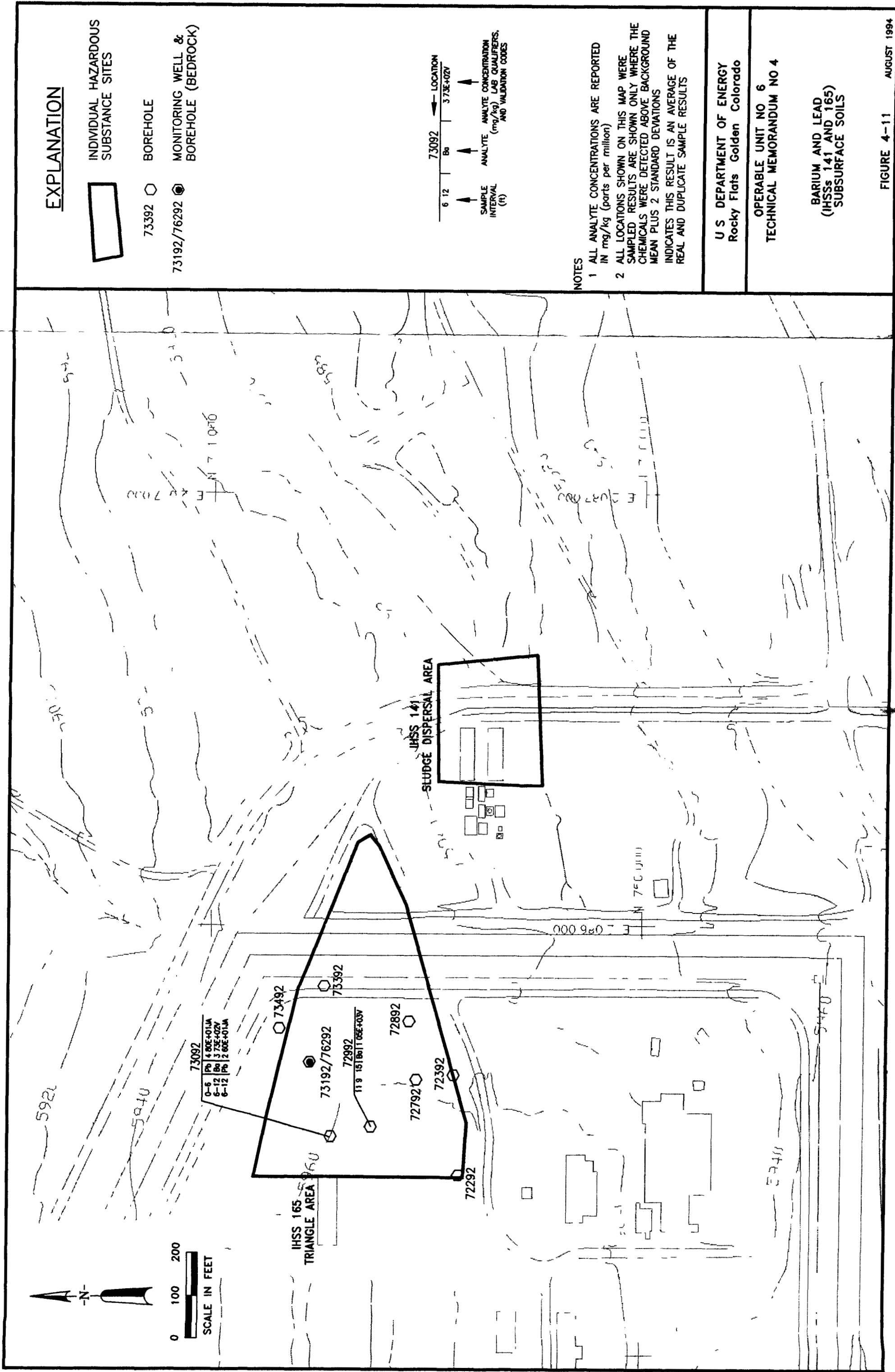


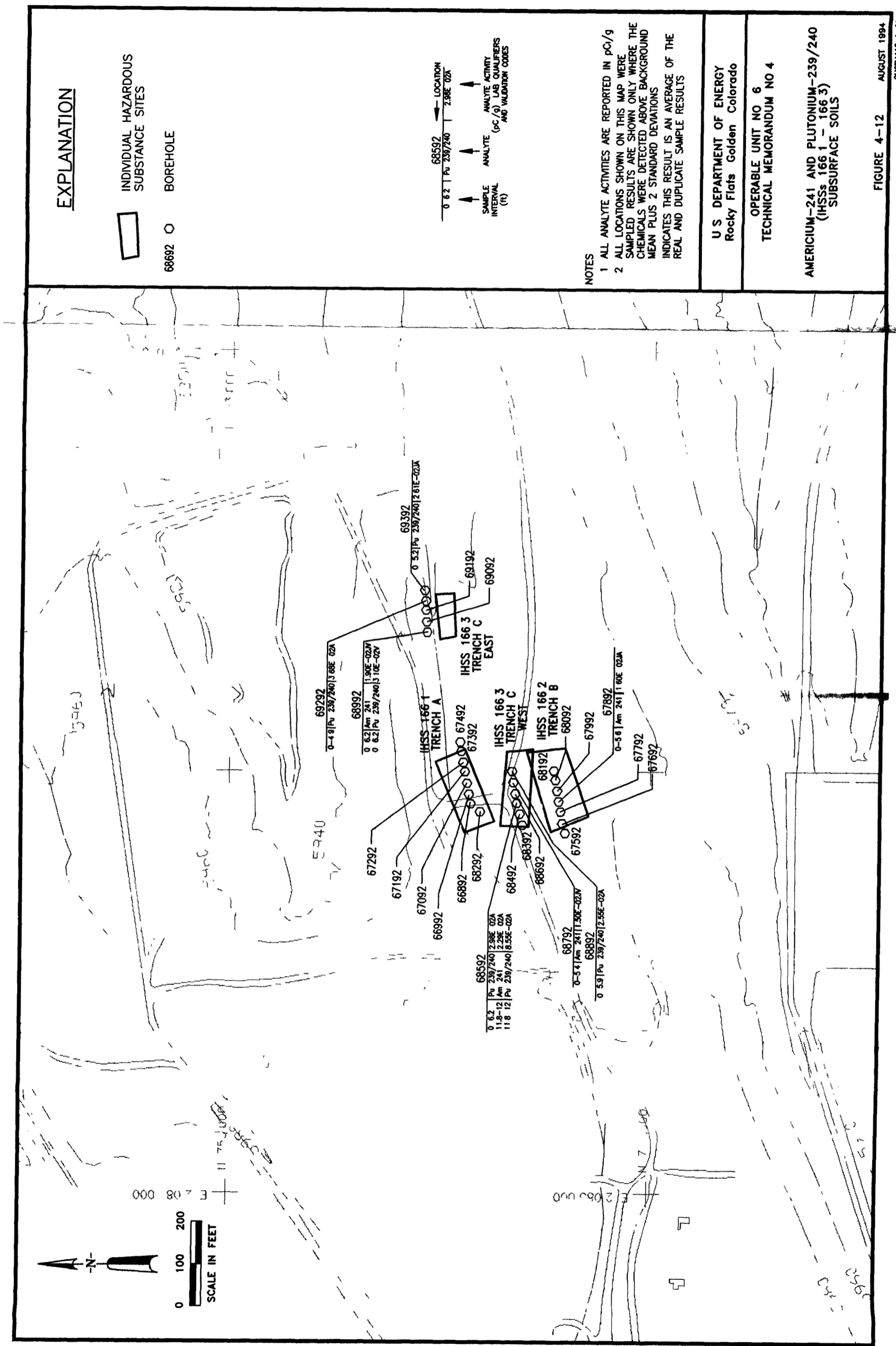
- NOTES**
- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN mg/kg (parts per million)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

BARIUM AND LEAD
(IHSSs 156.2 AND 216.1)
SUBSURFACE SOILS

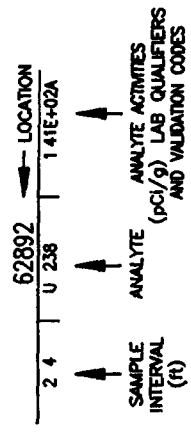




EXPLANATION

INDIVIDUAL HAZARDOUS SUBSTANCE SITES

62892 O BOREHOLE



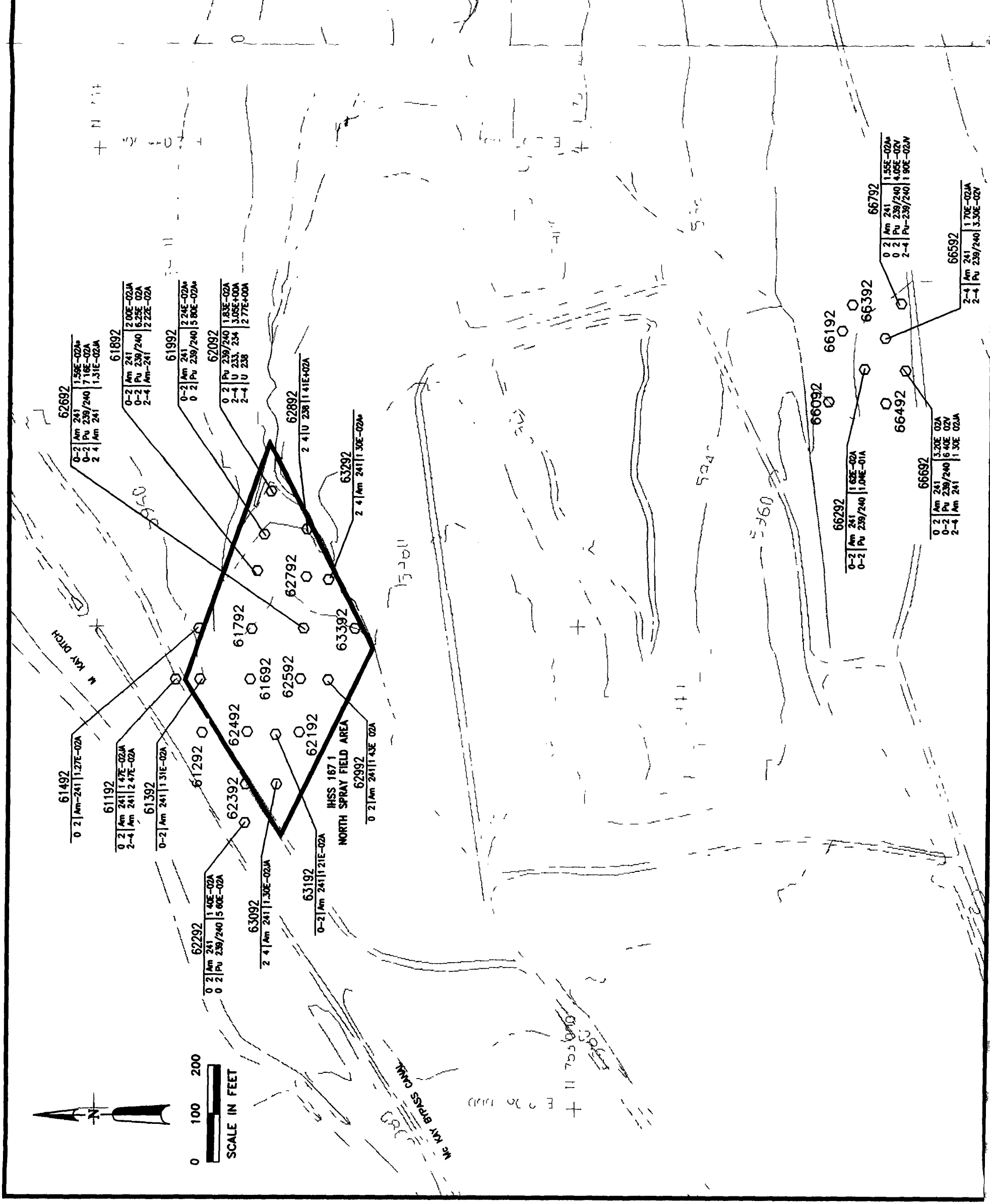
NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/l
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED RESULTS ARE SHOWN ONLY WHERE THE
CHEMICALS WERE DETECTED ABOVE BACKGROUND
MEAN PLUS 2 STANDARD DEVIATIONS
INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

**OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4**

**AMERICIUM-241 PLUTONIUM-239/240
AND URANIUM-238
(IHSS 167 1)
SUBSURFACE SOILS**



EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



73592 ○ BOREHOLE
75892 ○ MONITORING WELL
(ALLUVIAL)

0 2 78392 Am 241 2.48E-02V
SAMPLE INTERVAL (ft) ANALYTE ANALYTE ACTIVITY (pCi/g) LAB QUALIFIERS AND VALIDATION CODES
LOCATION 2.48E-02V

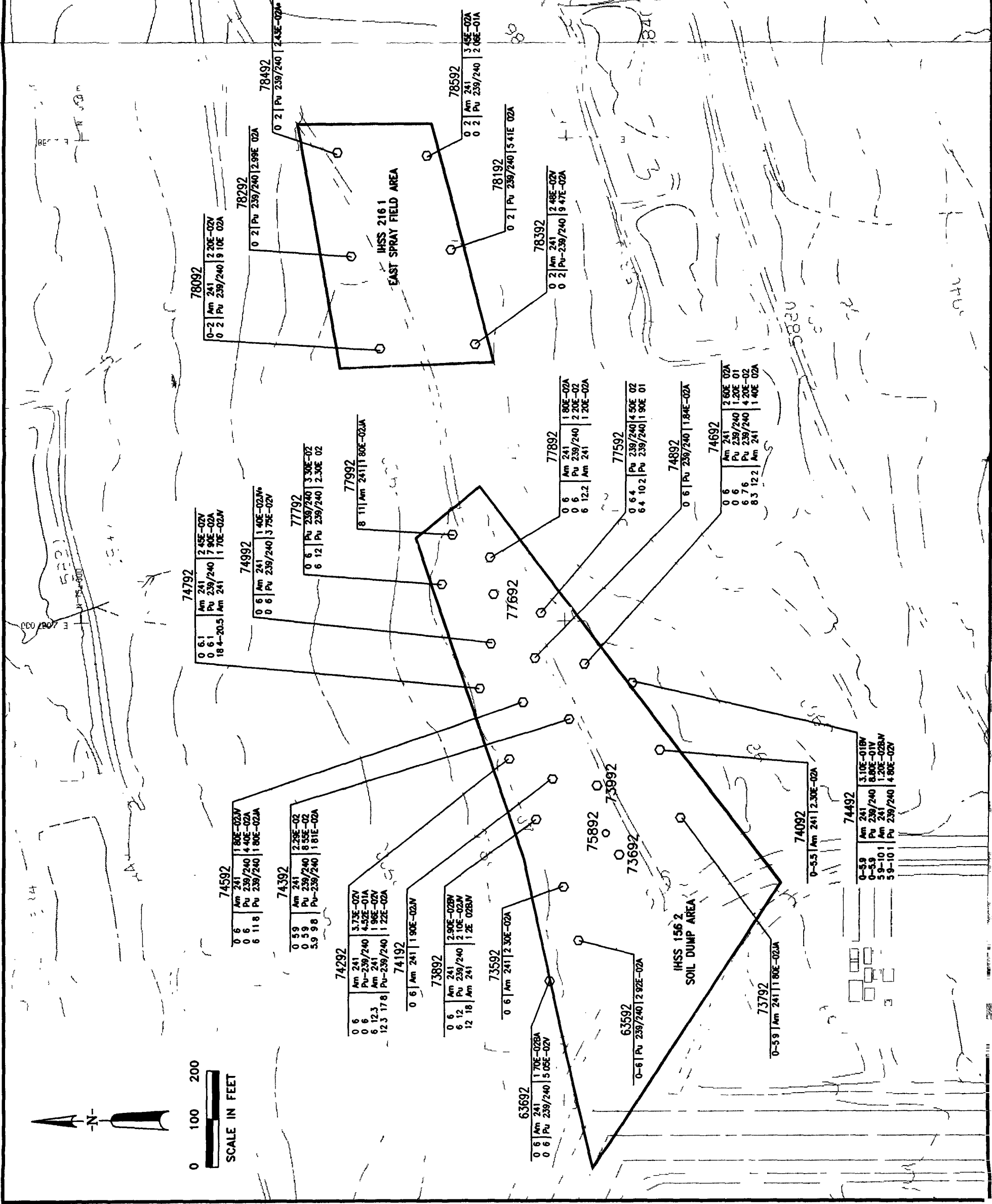
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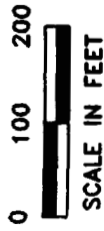
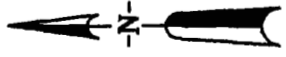
- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/l
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AMERICIUM-241 AND PLUTONIUM-239/240
(IHSSs 156.2 AND 216.1)
SUBSURFACE SOILS





0.6	Am-241	1.80E-01A
0.6	Pu-239/240	8.80E-02A
6-12	Am-241	1.40E-02A
6-12	U-238	1.60E-00BA

IHSS 165
TRIANGLE AREA

0.6	Am-241	3.40E-02A
0.6	Pu-239/240	1.73E-02A

0-5.6	Am-241	3.08E-02
0-5.6	Pu-239/240	6.17E-02

0.58	Am-241	1.04E-01
5.8	Am-241	1.40E-02

0.62	Pu-239/240	9.74E-02A
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0.56	Am-241	4.40E-01A
0.56	Pu-239/240	5.30E-01V

0-6.2	Am-241	2.22E-02
0-6.2	Pu-239/240	1.84E-02

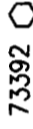
0.6	Am-241	6.99E-02
0.6	Pu-239/240	1.66E-01
6-12.4	Am-241	1.20E-02

IHSS 141
SLUDGE DISPERSAL AREA

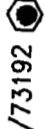
EXPLANATION



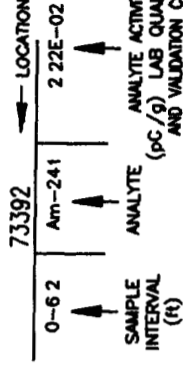
INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



BOREHOLE



BEDROCK MONITORING
WELL/BOREHOLE



NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/g
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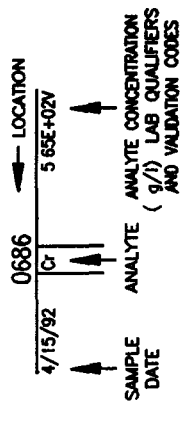
U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AMERICIUM-241 PLUTONIUM-239/240
AND URANIUM-238
(IHSSs 141 AND 165)
SUBSURFACE SOILS

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITES
- MONITORING WELL (ALLUVIAL)
- 0586
- UHSU = UPPER HYDROSTRATIGRAPHIC UNIT



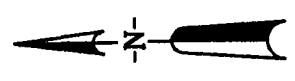
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/l (parts per billion)
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U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

UNFILTERED METALS
AREA 1 (UNNAMED TRIBUTARY DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993



0 300 600
SCALE IN FEET

7187
IHSS 1671
NORTH SPRAY FIELD AREA

7087
NEW IHSS 1672
POND SPRAY FIELD AREA

7187
NEW IHSS 1673
SOUTH SPRAY FIELD AREA

7287
IHSS 1661
TRENCH A

7287
IHSS 1663
TRENCH C

7287
IHSS 1662
TRENCH B

7287
IHSS 1663
TRENCH C

7287
IHSS 1663
TRENCH C

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IHSS 1663
TRENCH C

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IHSS 1663
TRENCH C

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IHSS 1663
TRENCH C

7287
IHSS 1663
TRENCH C

0686
4/15/92 Cr 5.65E+02V
4/15/92 U 3.98E+02V
4/15/92 Ni 2.11E+02V
4/15/92 Sr 2.70E+02NA
4/15/92 Sr 2.78E+03V

7287
IHSS 1663
TRENCH C

7287
IHSS 1663
TRENCH C

7287
IHSS 1663
TRENCH C

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IHSS 1663
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IHSS 1663
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IHSS 1663
TRENCH C

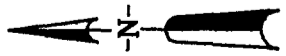
7287
IHSS 1663
TRENCH C

7287
IHSS 1663
TRENCH C

7287
IHSS 1663
TRENCH C

7287
IHSS 1663
TRENCH C

7/15/91	Ag	2.17E+02V	7/1/92	Sr	9.61E+02NA
7/15/91	Ba	2.99E+02V	7/1/92	V	4.42E+02NA
7/15/91	Ca	1.17E+03V	7/1/92	Zn	3.46E+03V
7/15/91	Co	8.46E+01V	10/7/92	Ag	6.95E+01V
7/15/91	Cr	1.14E+01NA	10/7/92	Ba	2.61E+02V
7/15/91	Cu	7.65E+02V	10/7/92	Ca	3.80E+01NA
7/15/91	Fe	2.74E+02V	10/7/92	Co	2.19E+02V
4/23/92	Ag	2.15E+04V	2/1/93	Ag	3.04E+03V
4/23/92	Ba	2.94E+02V	2/1/93	As	4.56E+00NA
4/23/92	Ca	1.36E+02V	2/1/93	Ba	5.08E+03V
4/23/92	Co	1.73E+03V	2/1/93	Ba	3.20E+01V
4/23/92	Cr	5.63E+01V	2/1/93	Ca	1.90E+01NA
4/23/92	Fe	4.00E+02NA	2/1/93	Co	2.28E+02V
7/1/92	Ag	1.49E+05NA	2/1/93	Cr	5.62E+02NA
7/1/92	Ba	2.15E+03V	2/1/93	Cu	6.43E+03V
7/1/92	Ca	1.41E+01V	2/1/93	Hg	1.40E+00V
7/1/92	Co	1.53E+01NA	2/1/93	Mn	2.68E+02V
7/1/92	Cr	1.3E+02V	2/1/93	Mn	6.20E+03V
7/1/92	Cu	2.25E+02V	2/1/93	Ni	1.07E+03V
7/1/92	Fe	1.64E+03V	2/1/93	Pb	1.83E+02V
7/1/92	Hg	2.77E+03V	2/1/93	Sr	1.74E+03V
7/1/92	Ni	4.68E+02V	2/1/93	V	7.54E+02NA
7/1/92	Pb	9.70E+01V	2/1/93	Zn	18.00E+03V



1786

3/4/91	Ag	3.92E+01JA	7/27/92	Sr	4.87E+03V
3/4/91	Ba	2.55E+02JA	7/27/92	As	5.63E+04V
3/4/91	Cd	3.29E+01JA	7/27/92	As	8.60E+02NJA
3/4/91	Cu	4.44E+01JA	7/27/92	As	5.98E+02N
3/4/91	Hg	3.08E+02V	7/27/92	Cd	5.98E+03JA
3/4/91	Mn	7.68E+01JA	7/27/92	Cu	5.38E+02V
3/4/91	Pb	1.36E+02JA	7/27/92	Pb	3.44E+01V
3/4/91	Sr	1.88E+02V	7/27/92	Sr	1.79E+02SNA
3/4/91	Sr	5.53E+03V	7/27/92	Sr	5.62E+03V
10/10/91	As	2.38E+04JA	7/27/92	V	1.54E+02EJA
10/10/91	Ba	3.93E+02JA	7/27/92	Zn	1.99E+02EJA
10/10/91	Cd	1.20E+01JA	7/27/92	U	3.18E+02V
10/10/91	Cd	3.05E+02V	7/27/92	U	3.67E+02V
10/10/91	Sr	2.00E+02V	7/27/92	Sr	1.58E+02V
10/10/91	Sr	5.41E+03V	7/27/92	Sr	6.04E+03JA
10/10/91	V	7.38E+01NJA	7/27/92	As	1.34E+05JA
1/9/92	As	1.01E+01V	2/1/93	As	1.80E+01NJA
1/9/92	Ba	8.67E+02	2/1/93	Ba	1.20E+03V
1/9/92	Ba	7.60E+00	2/1/93	Ba	1.33E+01V
1/9/92	Co	3.88E+01B	2/1/93	Co	5.48E+01V
1/9/92	Co	1.20E+02	2/1/93	Hg	1.61E+02V
1/9/92	Hg	3.78E+02	2/1/93	K	2.12E+04V
1/9/92	Mn	8.32E+02	2/1/93	K	4.38E+02V
1/9/92	Mn	9.94E+01	2/1/93	Mn	1.18E+03V
1/9/92	Pb	7.51E+01	2/1/93	Mn	1.43E+02V
1/9/92	Sr	1.88E+02S	2/1/93	Pb	1.21E+02SV
1/9/92	Sr	5.98E+03	2/1/93	Sr	3.67E+01JA
1/9/92	V	1.98E+02	2/1/93	Sr	1.43E+02SJA
1/9/92	Zn	3.62E+02	2/1/93	Sr	6.94E+03V
4/7/92	Co	3.17E+02V	2/1/93	V	2.34E+02NJA
4/7/92	Co	4.98E+03V	2/1/93	Z	5.72E+02V
4/7/92	Se	1.58E+02V			

1586

7/11/91	Ba	3.34E+02E
7/11/91	Sr	4.76E+01BN
7/11/91	Sr	2.78E+03
10/21/91	Ba	2.72E+02V
10/21/91	Co	7.72E+05V
10/21/91	Co	6.51E+01JA
10/21/91	Sr	1.30E+03V
1/15/92	Ba	2.43E+02V
1/15/92	Sr	1.17E+03V
4/13/92	Sr	1.23E+03V
7/16/92	Ba	3.77E+02V
7/16/92	Pb	2.37E+01V
7/16/92	Sr	1.40E+03V
10/7/92	Ba	2.78E+02V
10/7/92	Sr	1.40E+03JA
2/5/93	Ba	2.69E+02V
2/5/93	Sr	1.24E+03V

1286

1/20/92	As	1.32E+04V
1/20/92	Ba	3.14E+02V
1/20/92	Cd	3.98E+01V
1/20/92	Mn	6.72E+02V
1/20/92	Pb	3.11E+01V
1/20/92	Sr	1.56E+03V
1/20/92	V	8.83E+01V
1/20/92	Z	1.86E+02E
4/15/92	As	1.98E+03V
4/15/92	As	1.48E+01NJA
4/15/92	Ba	2.09E+03V
4/15/92	Ba	1.48E+01JA
4/15/92	Co	2.02E+01JA
4/15/92	Co	2.18E+02V
4/15/92	Co	3.14E+02V
4/15/92	Hg	5.60E+01V
4/15/92	Hg	2.67E+02V
4/15/92	Mn	3.32E+03V
4/15/92	Mn	2.64E+02V
4/15/92	Pb	2.54E+02JA
4/15/92	Sr	2.38E+03V
4/15/92	Sr	4.64E+02V
4/15/92	Zn	1.53E+03V
7/13/92	Pb	1.82E+01V
7/13/92	Sr	1.08E+03V

1186

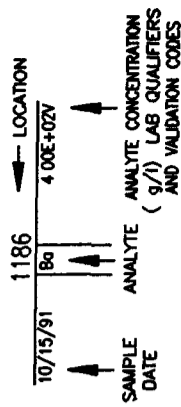
10/15/91	Ba	4.00E+02V
10/15/91	Ba	5.60E+00V
10/15/91	Mn	8.88E+02V
10/15/91	As	1.10E+02V
10/15/91	Pb	3.85E+01V

POND A-4
IHSS 142.4

POND A-2
IHSS 142.2

POND A-1
IHSS 142.1

POND A-3
IHSS 142.3



NOTES

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U.S. DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO. 6
TECHNICAL MEMORANDUM NO. 4

UNFILTERED METALS
AREA 2 (NORTH WALNUT CREEK DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

EXPLANATION

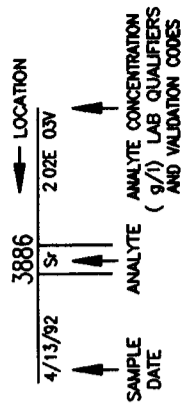
INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



3586 ○ MONITORING WELL
(ALLUVIAL)

02691 ● MONITORING WELL
(BEDROCK)

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT



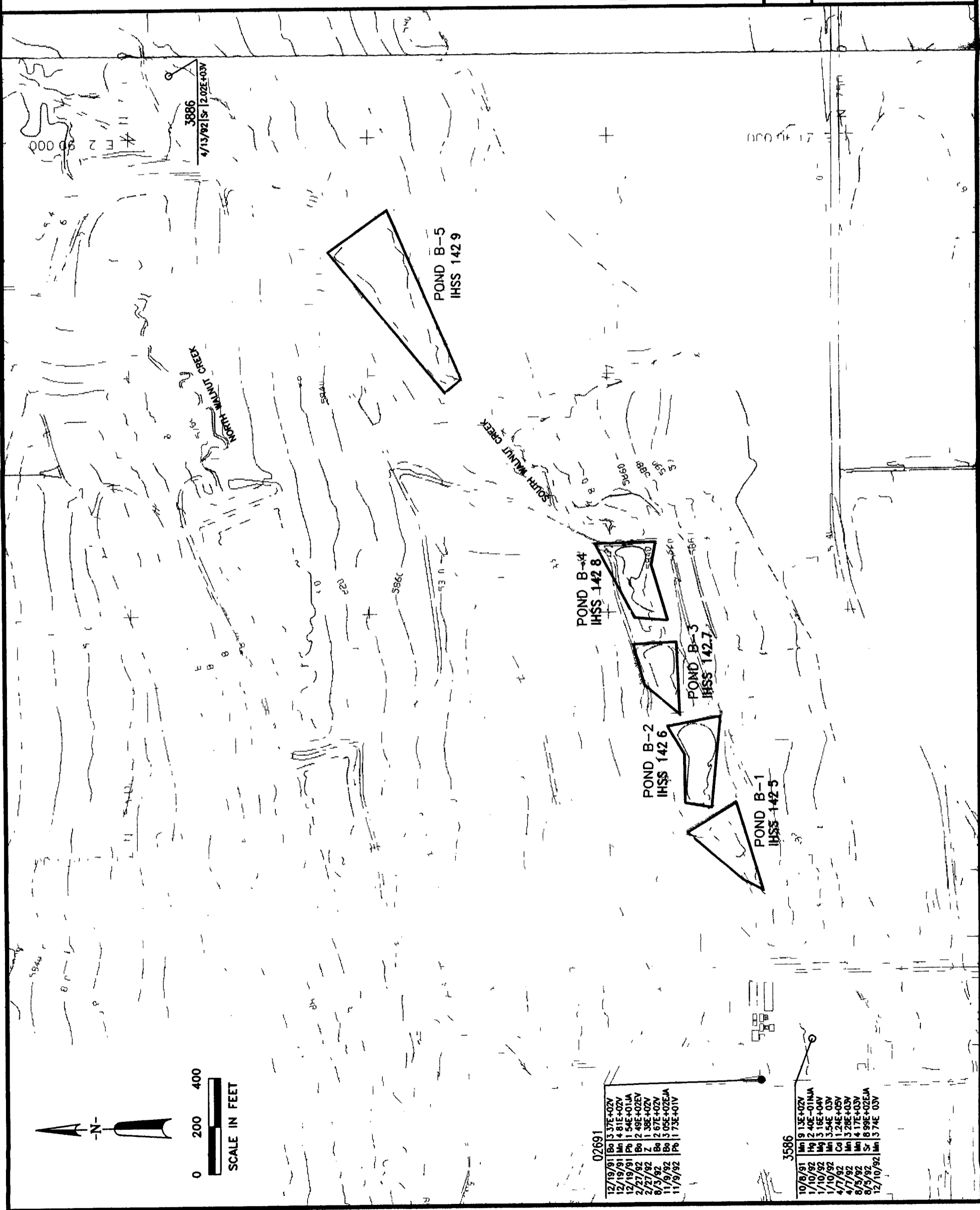
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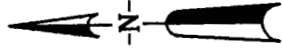
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U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

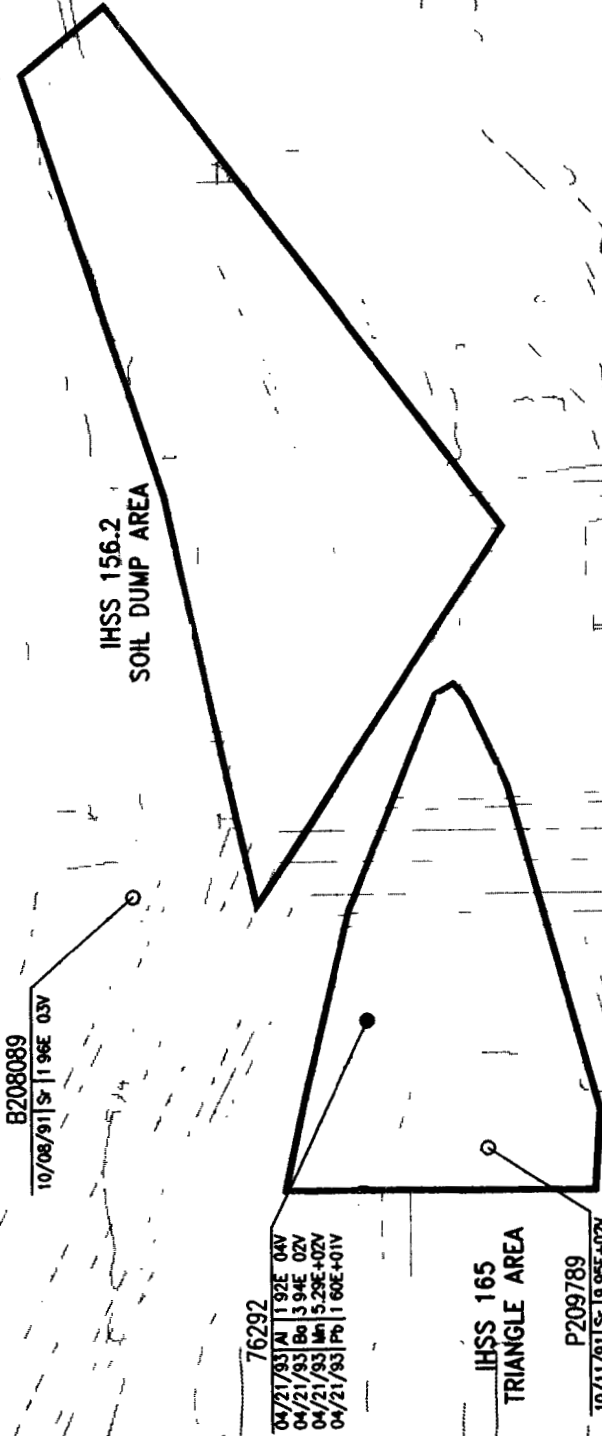
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

UNFILTERED METALS
AREA 3 (SOUTH WALNUT CREEK DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993





0 150 300
SCALE IN FEET



EXPLANATION

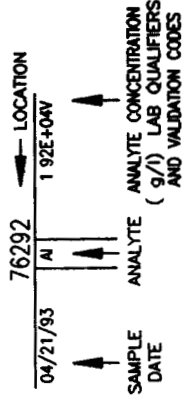


INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

2986 ○ MONITORING WELL
(ALLUVIAL)

76292 ● MONITORING WELL
(BEDROCK)

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT



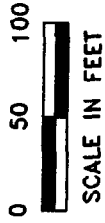
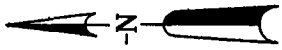
NOTES

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IN ug/l (parts per billion)
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THE CHEMICALS WERE DETECTED ABOVE BACKGROUND
MEAN PLUS 2 STANDARD DEVIATIONS
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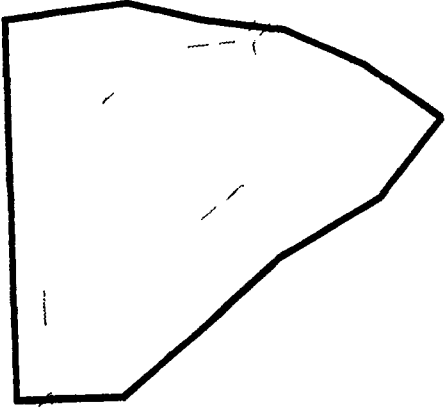
U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

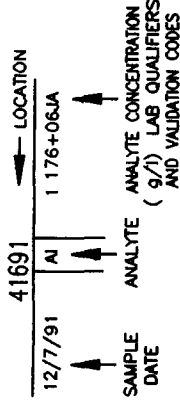
UNFILTERED METALS
AREA 4 (UPGRADIENT DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993



W&I POND
IHSS 142 12



41691			0486		
12/7/91	Al	1.7E+05A	9/12/91	Al	2.85E+04V
12/7/91	Ba	1.32E+03V	9/12/91	Ba	4.95E+02V
12/7/91	Bb	8.30E+00A	9/12/91	Cu	4.43E+01V
12/7/91	Ca	6.20E+00A	9/12/91	Mn	2.46E+03V
12/7/91	Co	8.11E+01V	9/12/91	Pb	2.81E+01V
12/7/91	Cr	1.84E+02V	9/12/91	Sb	5.38E+01BV
12/7/91	Cu	1.88E+02A	9/12/91	V	7.31E+01V
12/7/91	Hg	3.60E-01V	9/12/91	Zn	5.02E+02V
12/7/91	Mn	3.01E+03V	11/14/91	Al	3.66E+04
12/7/91	Ni	1.98E+02V	11/14/91	As	8.00E+00B
12/7/91	Pb	9.66E+01SV	11/14/91	Ba	7.86E+02
12/7/91	Se	1.94E+02A	11/14/91	Bb	3.90E+00B
12/7/91	Si	3.31E+02A	11/14/91	Co	4.67E+01B
12/7/91	Sn	3.72E+02V	11/14/91	Cr	2.38E+02
12/7/91	Zn	6.65E+02EJA	11/14/91	Cu	8.93E+01
4/1/92	Al	3.01E+04V	11/14/91	Mn	3.19E+03
4/1/92	Ba	4.27E+02V	11/14/91	Ni	1.86E+02
4/1/92	Ca	4.65E+01V	11/14/91	Pb	6.12E+01
4/1/92	Cu	1.59E+03V	11/14/91	Sb	1.17E+02
4/1/92	Hg	3.28E+01V	11/14/91	V	1.09E+02
4/1/92	Ni	3.92E+01V	11/14/91	Zn	2.63E+02
4/1/92	Se	1.60E+02EJA	4/1/92	Mn	1.14E+03V
6/11/92	Ag	1.03E+01A	6/11/92	Al	2.10E+04A
6/11/92	Ba	6.42E+04A	6/11/92	Ba	3.53E+02V
6/11/92	Co	6.09E+02V	6/11/92	Cr	2.47E+02V
6/11/92	Cu	6.97E+01V	6/11/92	Mn	1.53E+03V
6/11/92	Hg	7.20E-01A	6/11/92	Ni	8.19E+01V
6/11/92	Mn	3.03E+04V	6/11/92	Pb	2.04E+01A
6/11/92	Ni	1.08E+03V	9/15/92	Ba	3.25E+02V
6/11/92	Pb	1.59E+01V	9/15/92	Mn	1.88E+03V
6/11/92	Se	5.04E+01V	9/15/92	Pb	1.58E+01V
6/11/92	Sn	5.00E+01A	11/18/92	Al	2.58E+04V
6/11/92	V	1.52E+02V	11/18/92	Ba	3.67E+02V
6/11/92	Zn	2.50E+02V	11/18/92	Cr	1.57E+02V
9/16/92	Al	2.54E+04A	11/18/92	Mn	1.81E+03V
9/16/92	Ba	3.13E+02V	11/18/92	Ni	7.49E+01A
9/16/92	Co	7.54E+02V	11/18/92	Pb	1.85E+01V
9/16/92	Pb	1.82E+01V	11/18/92	V	6.68E+01V
9/16/92	Sn	2.82E+02V			
11/18/92	Ba	8.78E+02V			
11/18/92	Mn	1.83E+01A			
11/18/92	Pb	8.48E+04V			
2/16/94	Ba	7.46E+02V			



NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/l (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS.

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

UNFILTERED METALS
AREA 5 (W&I DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

FIGURE 5-8

AUGUST 1994

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



MONITORING WELL
(ALLUVIAL)

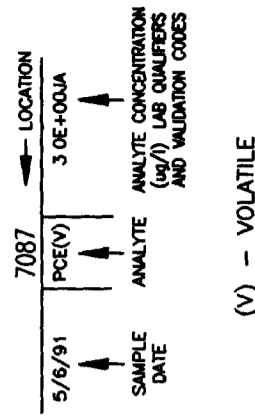


MONITORING WELL
(BEDROCK)



B206889

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT



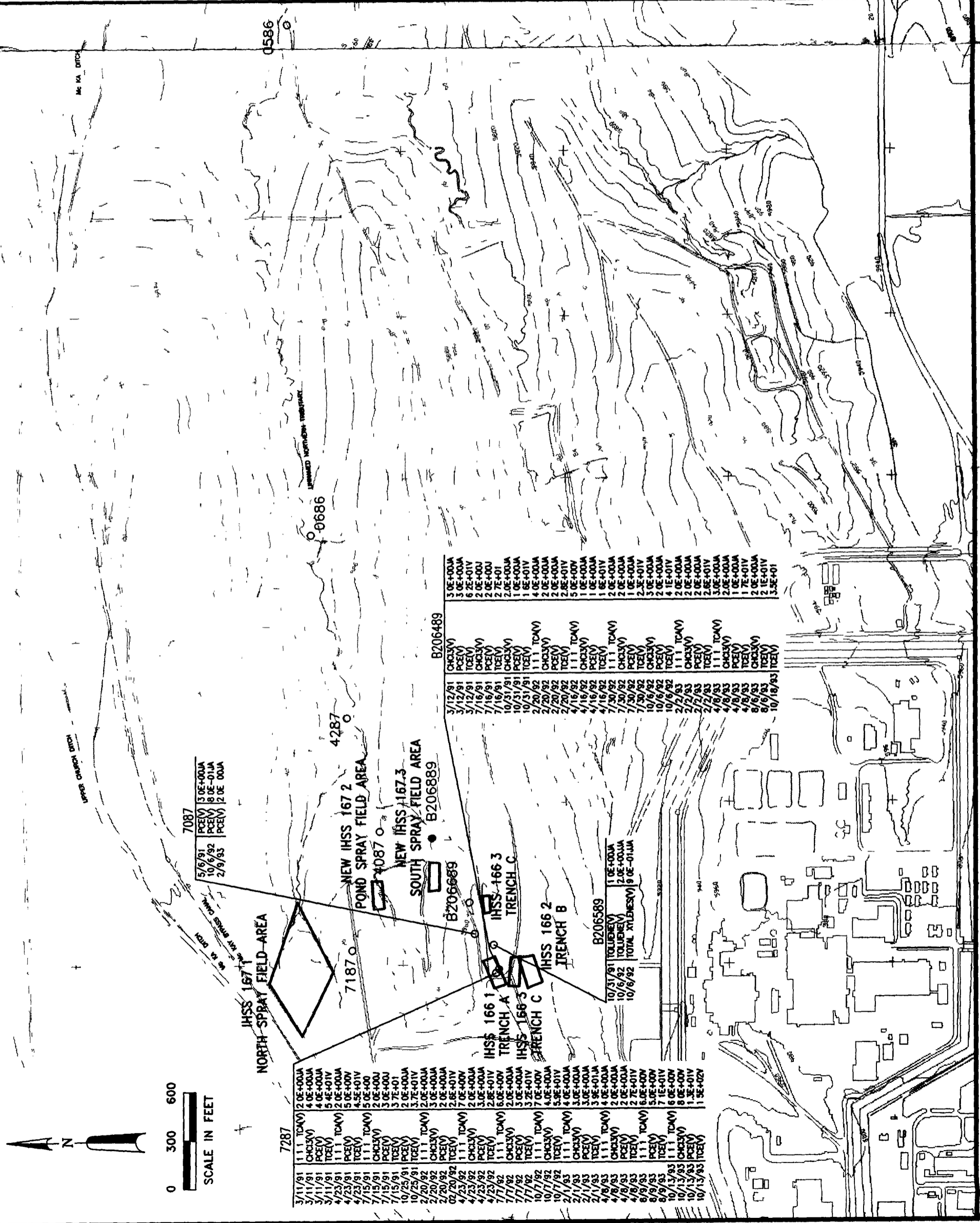
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/l (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

1,1,1-TRICHLOROETHANE CHLOROFORM
TETRACHLOROETHENE AND TRICHLOROETHENE
AREA 1 (UNNAMED TRIBUTARY DRAINAGE)
USHU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993



EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



1186 ○ MONITORING WELL
(ALLUVIAL)

1886 ■ MONITORING WELL
(COLLUVIAL)

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT

3/17/92	41091	LOCATION
↑	TCE(V)	22E-01BJA
↑	ANALYTE	ANALYTE CONCENTRATION (g/l) LAB QUALIFIERS AND VALIDATION CODES

(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED
IN ug/l (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED. RESULTS ARE SHOWN ONLY WHERE
THE CHEMICALS WERE DETECTED
 - 3 PESTICIDE/PCB ANALYSES WERE PERFORMED ONLY
AT LOCATION 41091
- INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

CHLOROFORM AND TRICHLOROETHENE
AREA 2 (NORTH WALNUT CREEK DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

FIGURE 5-10

AUGUST 1994

04674510 1-600



EXPLANATION

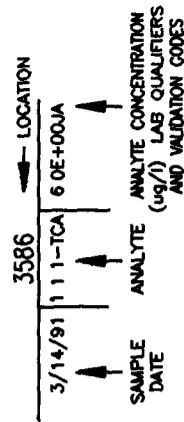
INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



3586 ○ MONITORING WELL
(ALLUVIAL)

02691 ● MONITORING WELL
(BEDROCK)

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT



(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/l (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED
 - 3 PESTICIDE/PCB ANALYSES WERE PERFORMED AT ONLY LOCATION 02691
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

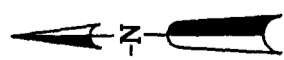
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

1,1,1-TRICHLOROETHANE 2-HEXANONE
TETRACHLOROETHENE TRICHLOROETHENE
AND VINYL CHLORIDE
AREA 3 (SOUTH WALNUT CREEK DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

FIGURE 5-11

AUGUST 1994

0670511 1 600



0 300 600

SCALE IN FEET

UNPAVED NORTH-EM-TRAIL

WALNUT CREEK

3586

POND B-5
IHSS 142.9

3786

POND B-4
IHSS 142.8

POND B-2
IHSS 142.6

POND B-3
IHSS 142.7

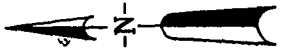
POND B-1
IHSS 142.5

3586

02691

7/27/92	PCEN	3.0E-01A
8/14/92	PCEN	2.2E+00
8/14/92	TCEN	1.7E-01
8/14/92	PCEN	3.0E-01V
8/14/92	PCEN	2.0E-01V
8/14/92	PCEN	1.0E-01V
8/14/92	PCEN	2.0E-01A
11/30/93	PCEN	2.0E-01A

3/14/91	1.11 TCAN	1.0E+00A
3/14/91	TCEN	2.0E+00A
3/14/91	WHIL CHLORIDE(V)	6.1E+02DV
4/29/91	1.11 TCAN	1.2E+01V
4/29/91	2-HEXANONE(V)	3.0E+00A
4/29/91	TCEN	6.0E+00V
4/29/91	WHIL CHLORIDE(V)	8.0E+02DV
10/8/91	1.11 TCAN	5.0E+00A
10/8/91	WHIL CHLORIDE(V)	3.8E+02V
10/8/91	1.11 TCAN	4.0E+02V
1/10/92	WHIL CHLORIDE(V)	7.2E+02DV
8/5/92	TCEN	9.0E+00V
8/5/92	WHIL CHLORIDE(V)	4.0E+00A
12/10/92	1.11 TCAN	5.3E+02EA
12/10/92	WHIL CHLORIDE(V)	3.0E+00A
3/5/93	1.11 TCAN	3.2E+02DV
3/5/93	WHIL CHLORIDE(V)	3.0E+00A
5/5/93	1.11 TCAN	2.2E+02DV
5/5/93	WHIL CHLORIDE(V)	5.0E+00V
5/5/93	WHIL CHLORIDE(V)	2.0E+02DV
5/5/93	WHIL CHLORIDE(V)	6.0E+00V
5/5/93	WHIL CHLORIDE(V)	4.0E+02DV
5/5/93	WHIL CHLORIDE(V)	3.0E+00V
5/5/93	WHIL CHLORIDE(V)	2.0E+02V



0 150 300
SCALE IN FEET

B208089	
3/28/91	PCBV
8/1/91	PCBV
10/11/91	PCBV
1/20/92	PCBV
2.0E+00A	
1.0E+00J	
1.0E+00A	
1.0E+00A	

P209789	
10/16/92	PCBV
10/16/92	TCBV
2/9/93	PCBV
2/9/93	TCBV
4/6/93	PCBV
4/6/93	TCBV
10/15/93	PCBV
10/15/93	TCBV
3.0E+00A	
2.0E+00A	
3.0E+00A	
2.0E+00A	
2.0E+00A	
3.0E+00A	
4.0E+00A	

IHSS 165
TRIANGLE AREA

P218389

2986

P219489

11/15/93 PCBV 1.0E+01V

IHSS 156.2
SOIL DUMP AREA

76292

3/22/93 CHC13 2.0E-01V

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



75892 ○
MONITORING WELL
(ALLUVIAL)

76292 ●
MONITORING WELL
(BEDROCK)

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT

76292	LOCATION
3/22/93	CHC13
ANALYTE	ANALYTE CONCENTRATION (g/l) LAB QUALIFIERS AND VALIDATION CODES
SAMPLE DATE	

(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED
IN ug/l (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED. RESULTS ARE SHOWN ONLY WHERE
THE CHEMICALS WERE DETECTED
 - 3 PESTICIDE/PCB ANALYSES WERE PERFORMED AT
ONLY LOCATIONS 76292 AND P218389
- INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

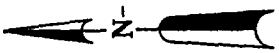
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

CHLOROFORM TETRACHLOROETHENE
AND TRICHLOROETHENE
AREA 4 (UPGRADIENT DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

FIGURE 5-12

AUGUST 1994

0067M512 1-300



0 300 600
SCALE IN FEET

7187

10/09/92 METHYLENE CHLORIDE(V) 3.2E+018A
04/09/93 METHYLENE CHLORIDE(V) 2.0E+00A

IHSS 167-1
NORTH SPRAY FIELD AREA

4087

04/28/92 METHYLENE CHLORIDE(V) 1.0E+00A

NEW IHSS 167-2
POND SPRAY FIELD AREA

7087

10/06/92 METHYLENE CHLORIDE(V) 9.0E-01A
10/20/93 METHYLENE CHLORIDE(V) 3.0E+00J

IHSS 166-1
TRENCH A

IHSS 166-3
TRENCH C

IHSS 166-2
TRENCH B

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

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IHSS 166-3
TRENCH C

IHSS 166-3
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IHSS 166-3
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IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

IHSS 166-3
TRENCH C

UPPER CANYON DITCH

UPPER CANYON DITCH

4287

02/17/93 METHYLENE CHLORIDE(V) 1.0E+00V

0686

0586

05/02/91 METHYLENE CHLORIDE(V) 2.0E+00A
10/07/92 METHYLENE CHLORIDE(V) 6.0E-01J

NEW IHSS 167-3
SOUTH SPRAY FIELD AREA

B206889

B206889

B206889

B206889

B206889

B206889

B206889

B206889

B206889

B206889

B206889

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B206889

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



0586 ○
MONITORING WELL
(ALLUVIAL)

B206889 ●
MONITORING WELL
(BEDROCK)

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT

0586
5/02/91 METHYLENE CHLORIDE 200E+00A
LOCATION

ANALYTE
ANALYTE CONCENTRATION
(ug/l) LAB QUALIFIERS
AND VALIDATION CODES

(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED
IN ug/l (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED RESULTS ARE SHOWN ONLY WHERE
THE CHEMICALS WERE DETECTED
INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
AREA 1 (UNNAMED TRIBUTARY DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

FIGURE 5-13

AUGUST 1994

040704513 1 600

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



MONITORING WELL
(ALLUVIAL)

3586 ○

MONITORING WELL
(BEDROCK)

02691 ●

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT

02691 ← LOCATION

12/19/91 METHYLENE CHLORIDE(V) 7.6E+00A

ANALYTE

ANALYTE CONCENTRATION
(ug/l) LAB QUALIFIERS
AND VALIDATION CODES

(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED
IN ug/l (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED. RESULTS ARE SHOWN ONLY WHERE
THE CHEMICALS WERE DETECTED
- INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

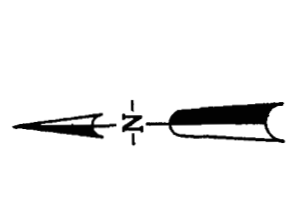
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
AREA 3 (SOUTH WALNUT CREEK DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

FIGURE 5-15

AUGUST 1994

03070515 1-600



0 300 600

SCALE IN FEET

3886
7/16/91 METHYLENE CHLORIDE(V) 1.5E+00

POND B-5
IHSS 142.9

3786

9/18/92 METHYLENE CHLORIDE(V) 1.0E+00A

POND B-4
IHSS 142.8

POND B-2
IHSS 142.6

POND B-3
IHSS 142.7

POND B-1
IHSS 142.5

3686
3/21/91 METHYLENE CHLORIDE(V) 1.0E+00B
4/30/91 METHYLENE CHLORIDE(V) 1.2E+01B

02691

12/19/91 METHYLENE CHLORIDE(V) 7.6E+00A
5/14/92 METHYLENE CHLORIDE(V) 1.4E+01

3586

4/14/91 METHYLENE CHLORIDE(V) 1.0E+01V
4/29/91 METHYLENE CHLORIDE(V) 1.0E+01V

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



MONITORING WELL
(ALLUVIAL)

1186 ○

MONITORING WELL
(COLLUVIAL)

1886 ■

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT

41091 LOCATION
3/17/92 METHYLENE CHLORIDE(V) 11 TE+000A
ANALYTE ANALYTE CONCENTRATION
(ug/l) LAB QUALIFIERS
AND VALIDATION CODES
SAMPLE DATE

(V) - VOLATILE
(SV) - SEMIVOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED
IN ug/l (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED. RESULTS ARE SHOWN ONLY WHERE
THE CHEMICALS WERE DETECTED
INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

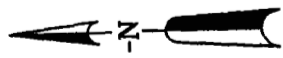
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
AREA 2 (NORTH WALNUT CREEK DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

FIGURE 5-14

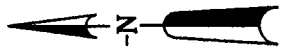
AUGUST 1994

OUR514 1-600

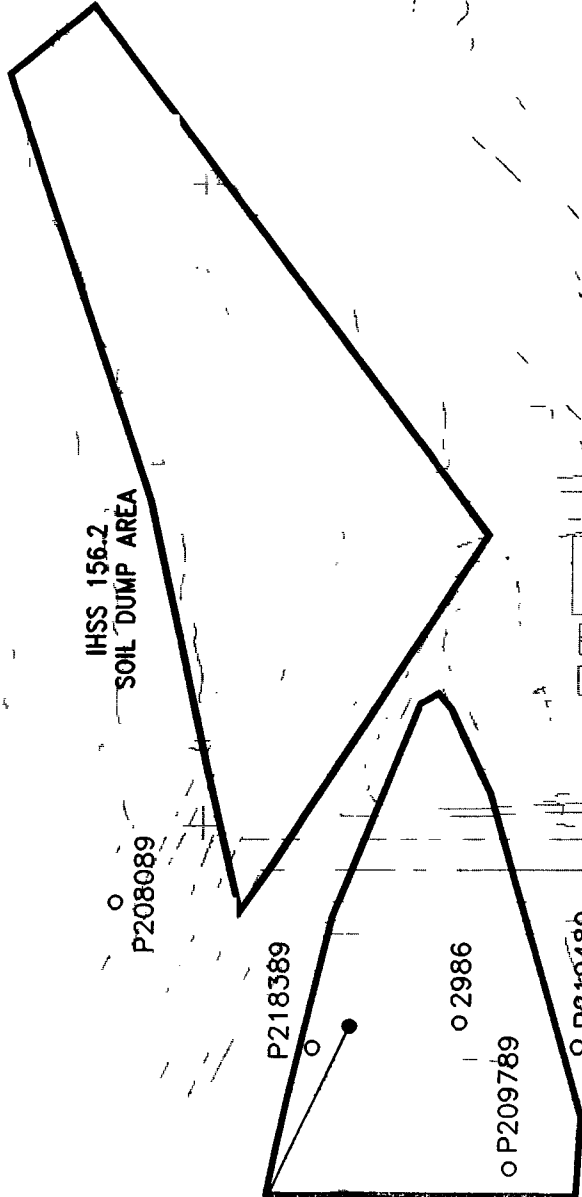


0 300 600
SCALE IN FEET





0 150 300
SCALE IN FEET



EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



2986 ○ MONITORING WELL
(ALLUVIAL)

76292 ● MONITORING WELL
(BEDROCK)

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT

76292 ← LOCATION
4/21/93 METHYLENE CHLORIDE(V) 2 OE 01V

↑ SAMPLE DATE ↑ ANALYTE ANALYTE CONCENTRATION
(g/l) LAB QUALIFIERS
AND VALIDATION CODES

(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED
IN ug/l (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED. RESULTS ARE SHOWN ONLY WHERE
THE CHEMICALS WERE DETECTED
INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

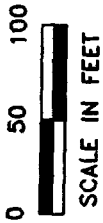
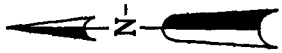
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
AREA 4 (UPGRADIENT DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

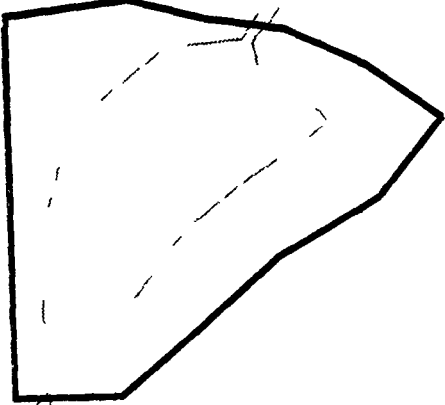
FIGURE 5-16

AUGUST 1994

OU6TMS16 1-300



W&I POND
IHSS 142 12



0486
3/14/91 METHYLENE CHLORIDE(V) 1 OE 01V

41691

EXPLANATION

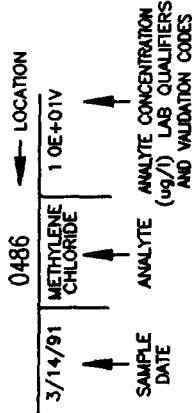
INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



MONITORING WELL
(ALLUVIAL)

41691 ○

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT



NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/l (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
AREA 5 (W&I DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

INDIVIDUAL HAZARDOUS SUBSTANCE SITES	MONITORING WELL (ALLUVIAL)	MONITORING WELL (BEDROCK)
	0586 ○	B206889 ●

UHSU = UPPER HYDROSTRATIGRAPHIC UNIT



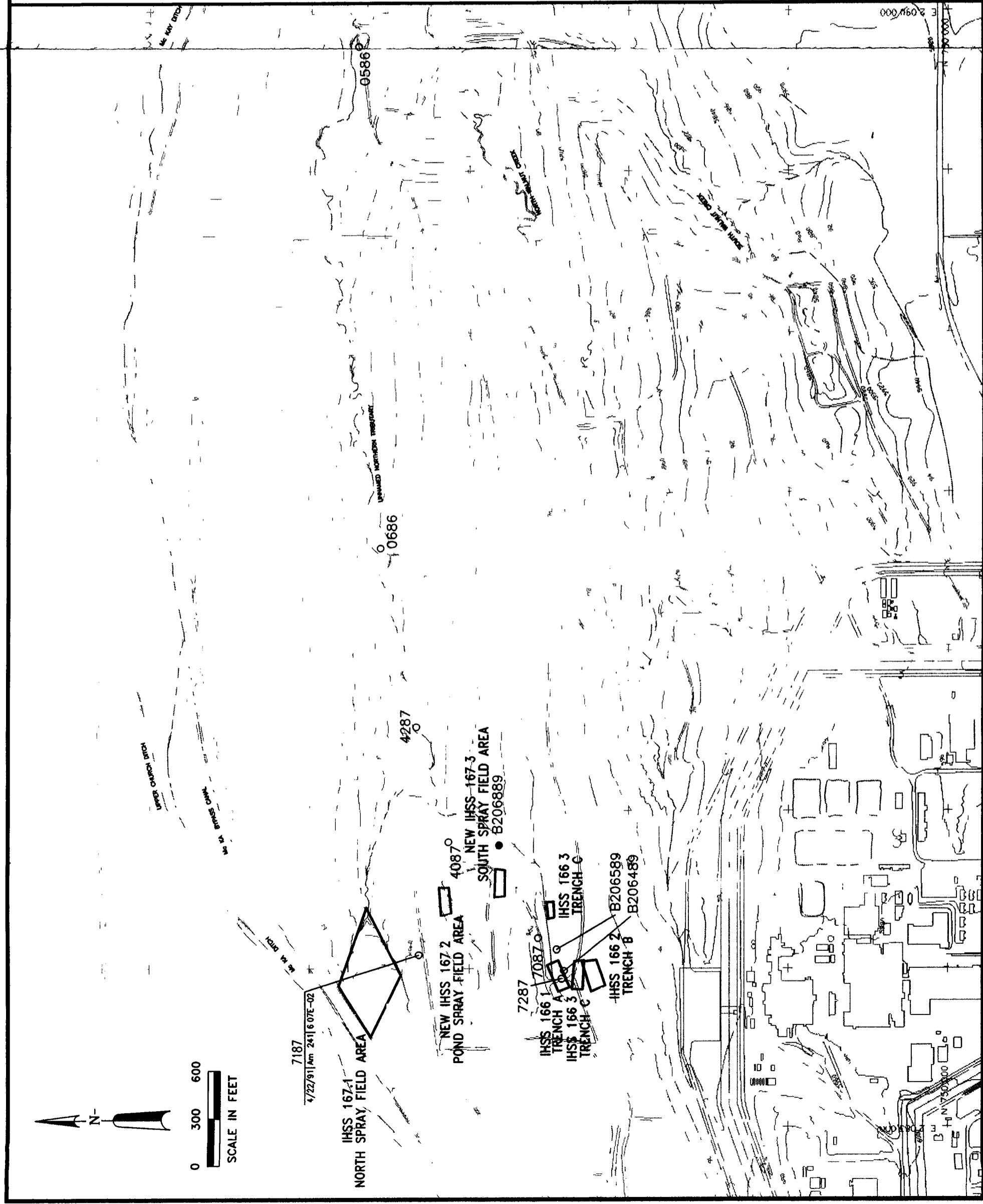
- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/l
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS

INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

**OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4**

AMERICIUM-241 (UNFILTERED)
AREA 1 (UNNAMED TRIBUTARY DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

FIGURE 5-18 **AUGUST 1994**

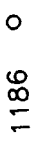


EXPLANATION

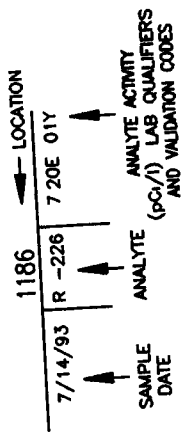
INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



MONITORING WELL
(ALLUVIAL)



UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT



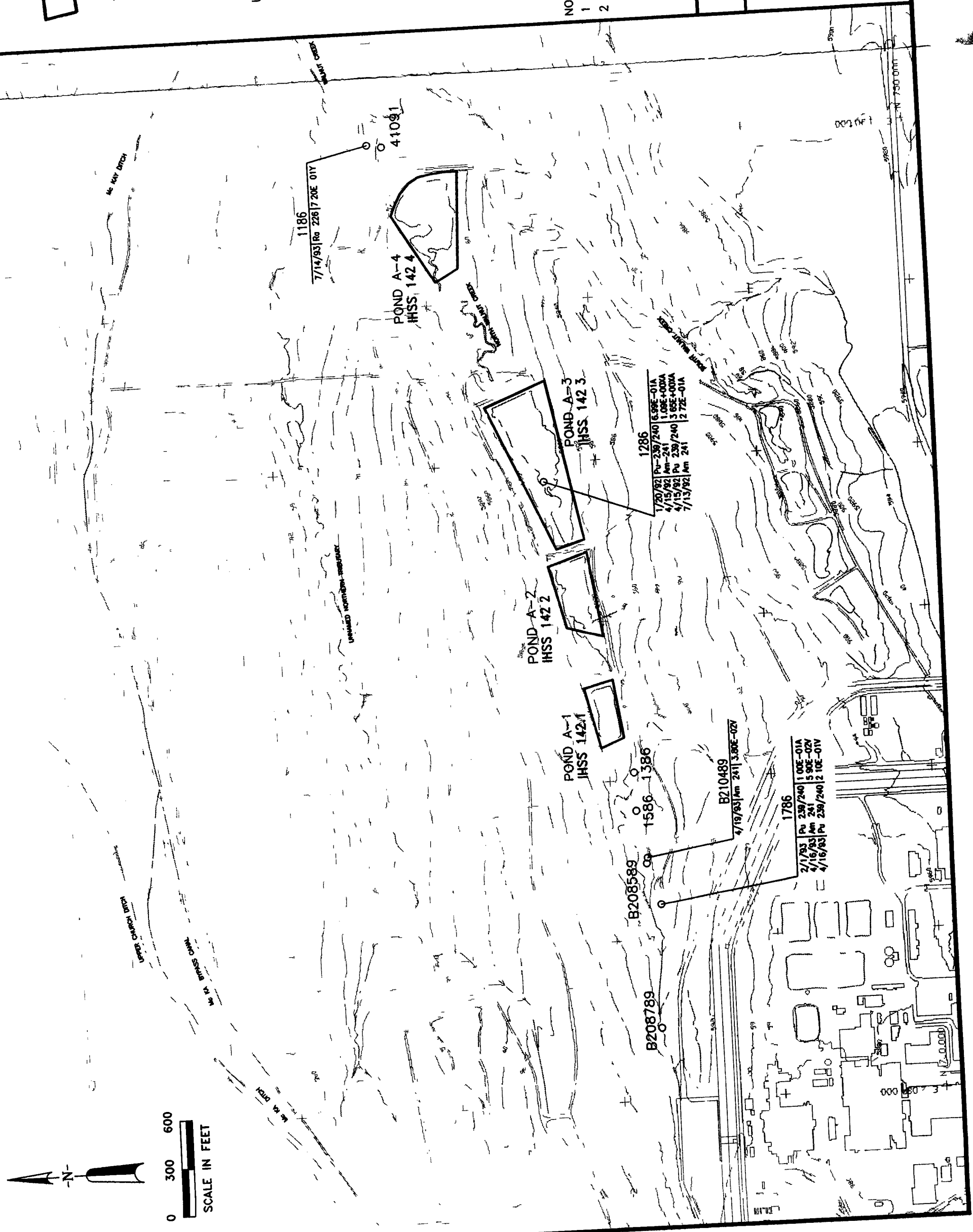
NOTES

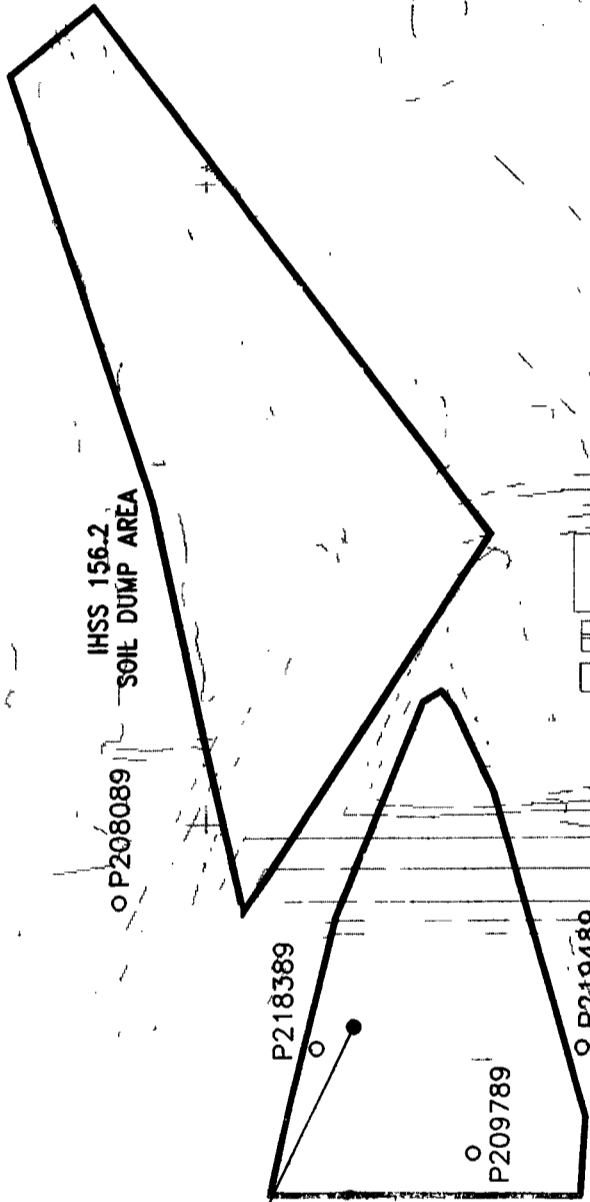
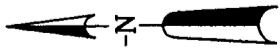
- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/l
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AMERICIUM-241 PLUTONIUM-239/240
AND RADIUM-226 (UNFILTERED)
AREA 2 (NORTH WALNUT CREEK DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993





EXPLANATION

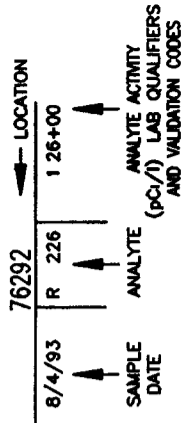
INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



2986 ○
MONITORING WELL
(ALLUVIAL)

76292 ●
MONITORING WELL
(BEDROCK)

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT



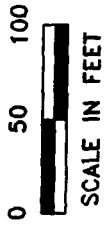
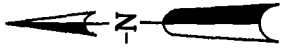
NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/l
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS.

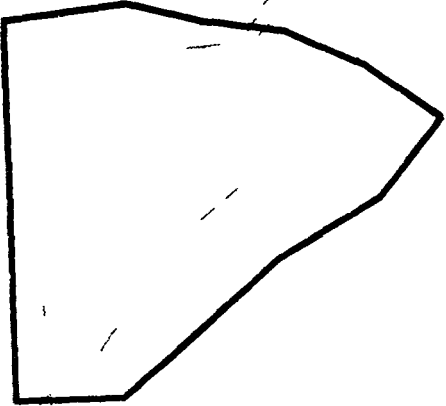
U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

RADIUM-226 (UNFILTERED)
AREA 4 (UPGRADIENT DRAINAGE)
UHSU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993



W&I POND
IHSS 142 12



0486

6/20/91	Pu 239/240	5.53E-02N
9/12/91	Pu 239/240	5.25E-02N
11/14/91	Am 241	4.23E-02A
11/14/91	Pu 239/240	1.79E-01A
4/1/92	Am 241	2.81E-02A
9/15/92	Am 241	3.91E-02A
11/18/92	Pu 239/240	5.30E-02A
7/12/93	R 226	1.10E+00Y

41691

12/7/91	Am 241	4.70E-01A
12/7/91	Pu 239/240	2.20E+00A
4/1/92	Am 241	2.20E-01XA
4/1/92	Pu 239/240	1.30E+00XA
9/16/92	Am 241	8.04E-02A
9/16/92	Pu 239/240	6.77E-01A
11/18/92	Am 241	1.00E-01A
11/18/92	Pu 239/240	3.40E-01A
3/17/93	Am 241	3.20E+00A
6/22/93	Am 241	8.60E-02V
6/22/93	Pu 239/240	5.60E-01V
9/20/93	Am 241	1.20E-01V
9/20/93	Pu 239/240	3.70E-01V
12/9/93	Am 241	5.03E-02Y
12/9/93	Pu 239/240	2.59E-01Y

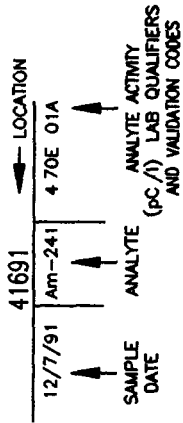
EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



41691 ○
MONITORING WELL
(ALLUVIAL)

UHSU = UPPER HYDROSTRATIGRAPHIC
UNIT



NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN PC/L
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

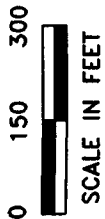
U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

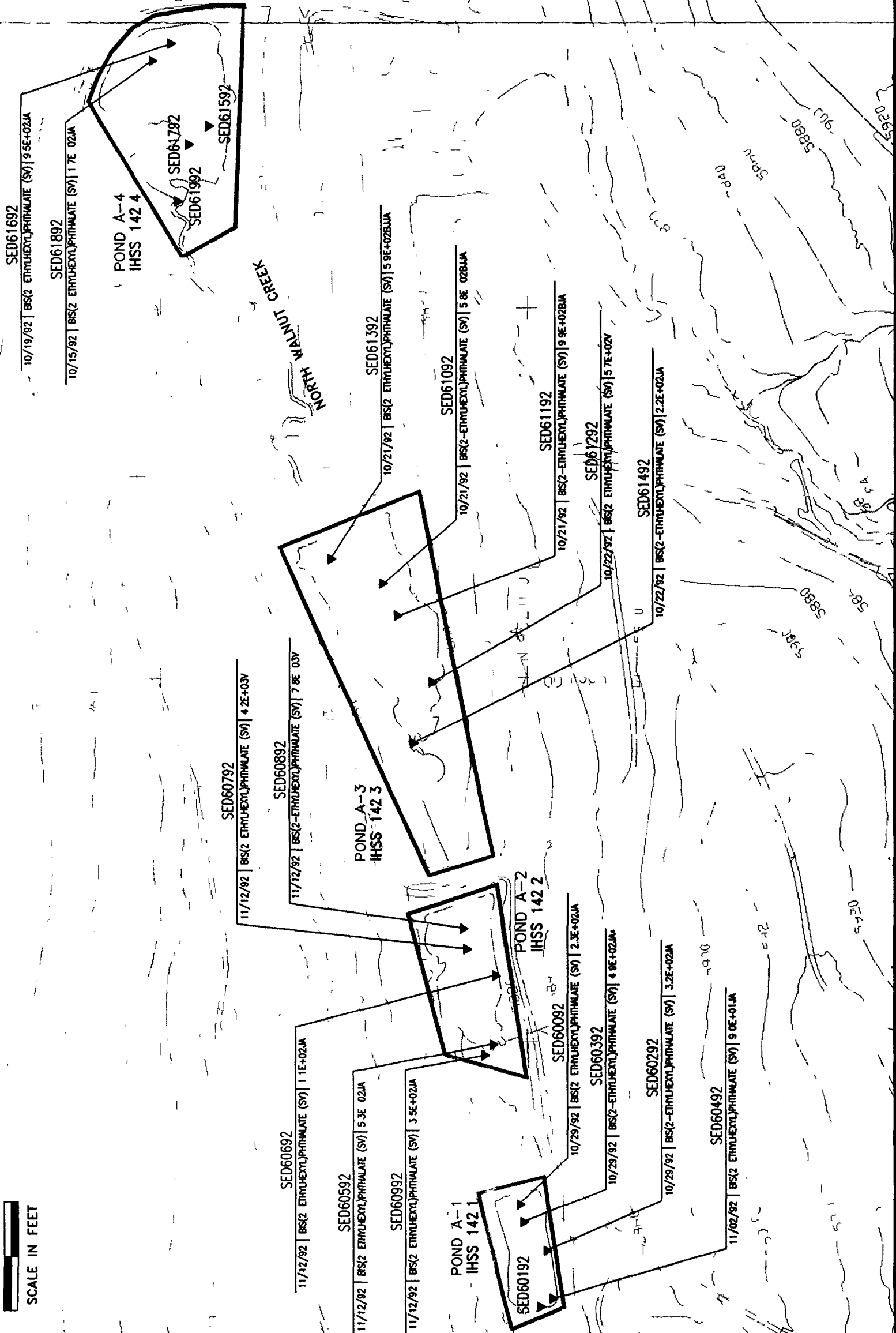
AMERICIUM-241 PLUTONIUM-239/240
AND RADIUM 226 (UNFILTERED)
AREA 5 (W&I DRAINAGE)
USHU GROUNDWATER
1st QUARTER 1991 - 4th QUARTER 1993

FIGURE 5-21

AUGUST 1994

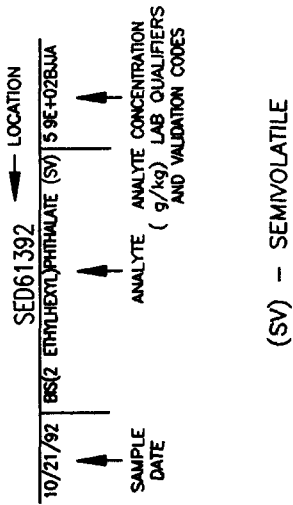


UNNAMED NORTHERN TRIBUTARY



EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITES
- POND SEDIMENT SAMPLE SITE SED61692



NOTES

- ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
- ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

BIS(2-ETHYLHEXYL)PHTHALATE
(IHSSs 142 1 - 142 4)
POND SEDIMENTS

INDIVIDUAL HAZARDOUS SUBSTANCE SITES

▼ POND SEDIMENT SAMPLE SITE
SED63892

SED64392	← LOCATION
10/19/92	ETHYLPHENYLPHOSPHATE (SV) 1 BE+02JA
	ANALYTE
	ANALYTE CONCENTRATION (ug/kg)
	LAB QUALIFIERS AND VALIDATION CODES
	SAMPLE DATE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED
- 3 ALL SAMPLES WERE COLLECTED FROM A DEPTH OF 0 TO 2 FEET UNLESS OTHERWISE INDICATED WITH A DEPTH NOTATION BESIDE THE LOCATION CODE

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

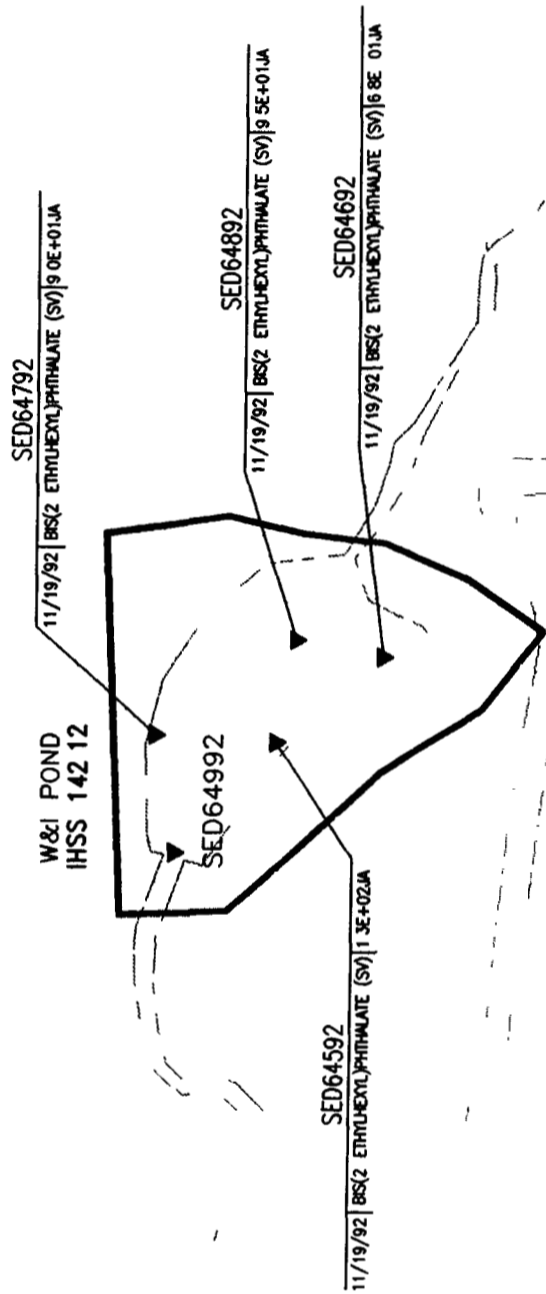
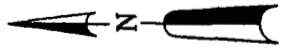
**OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4**

**BIS(2-ETHYLHEXYL)PHTHALATE
(IHSSs 142 5 - 142 9)
POND SEDIMENTS**

FIGURE 6-2

AUGUST 1994

0U6T1062 1=300

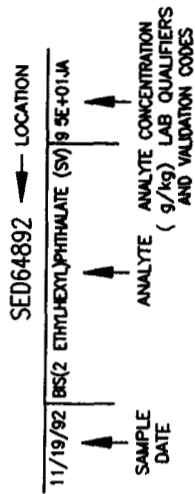


EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



▼ POND SEDIMENT SAMPLE SITE
SED64592



(SV) - SEMIVOLATILE

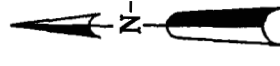
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

BIS(2-ETHYLHEXYL)PHTHALATE
(IHSS 142 12)
POND SEDIMENTS



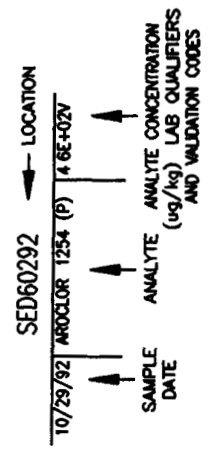
UNNAMED NORTHERN TRIBUTARY

0 150 300
SCALE IN FEET

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

▼ POND SEDIMENT SAMPLE SITE
SED61892

EXPLANATION



(SV) - SEMIVOLATILE
(P) - PESTICIDE/PCB

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AROCOR-1254 AND PAH COCs
(IHSSs 142 1 - 142 4)
POND SEDIMENTS

FIGURE 6-4

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

▼ POND SEDIMENT SAMPLE SITE
SED64292

SED63892 ← LOCATION
10/22/92 BENZO(a) PYRENE (SV) 4.0E+02JA
↑ ANALYTE ANALYTE CONCENTRATION
↑ (g/kg) LAB QUALIFIERS
↑ AND VALIDATION CODES

(SV) - SEMIVOLATILE
(P) - PESTICIDES/PCBs

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

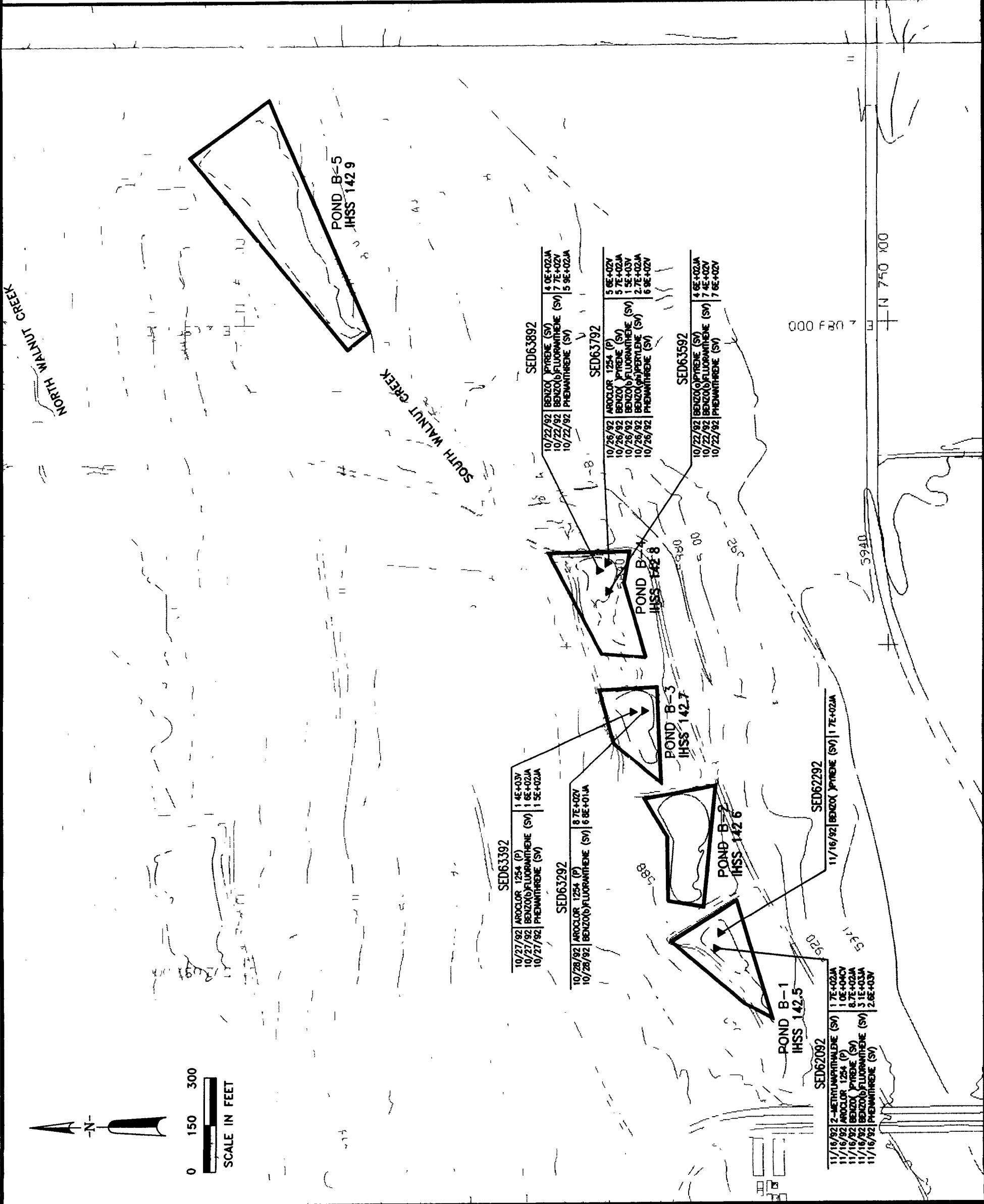
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

2-METHYLNAPHTHALENE AROCLOR-1254
AND PAH COCs
(IHSSs 142.5 - 142.9)
POND SEDIMENTS
2-4 DEPTH

FIGURE 6-6

AUGUST 1994

06TMO66 1-300



EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

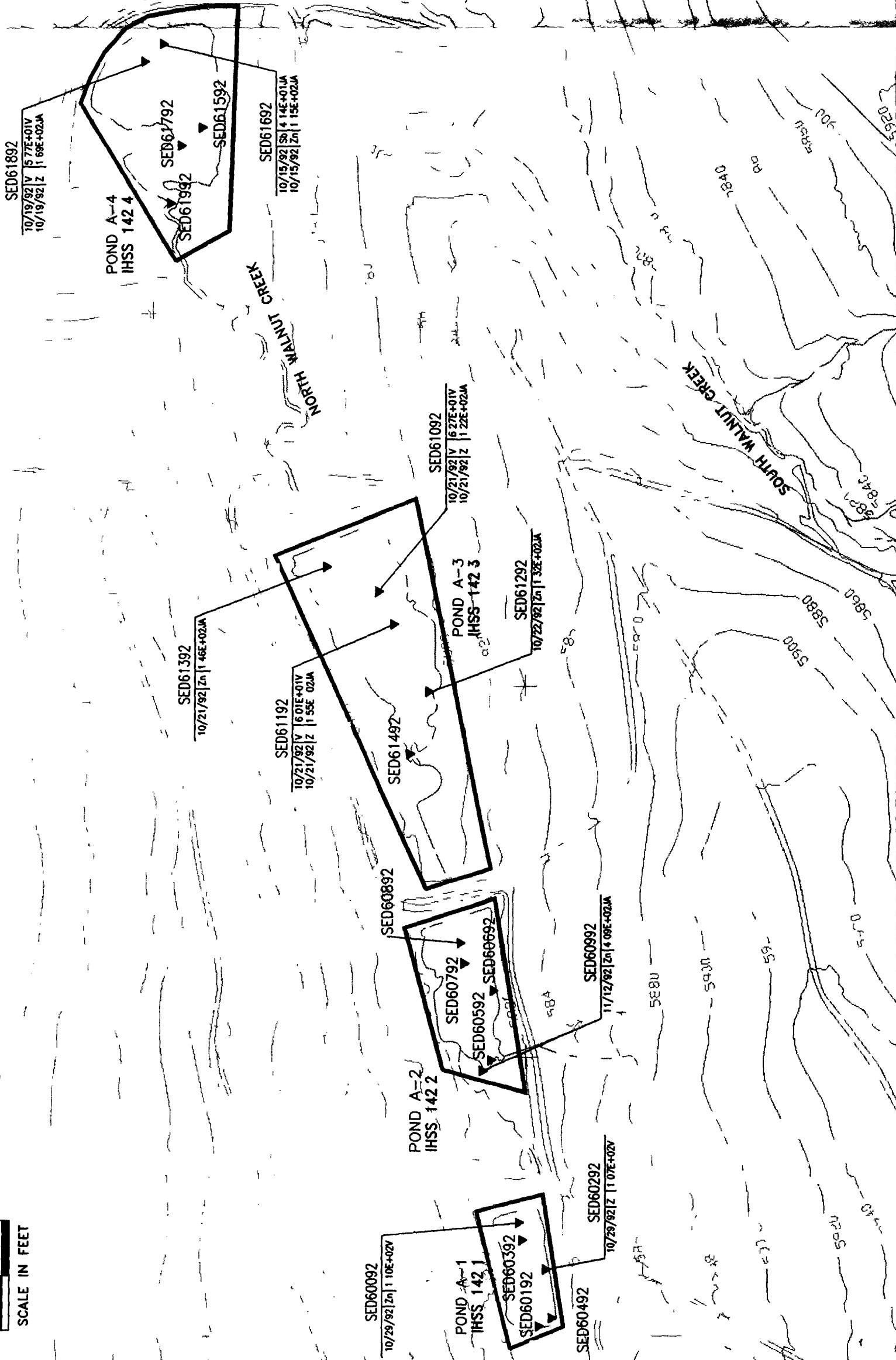
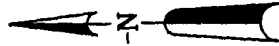
POND SEDIMENT
SAMPLE SITE

SED61792



UNNAMED NORTHERN TRIBUTARY

0 150 300
SCALE IN FEET



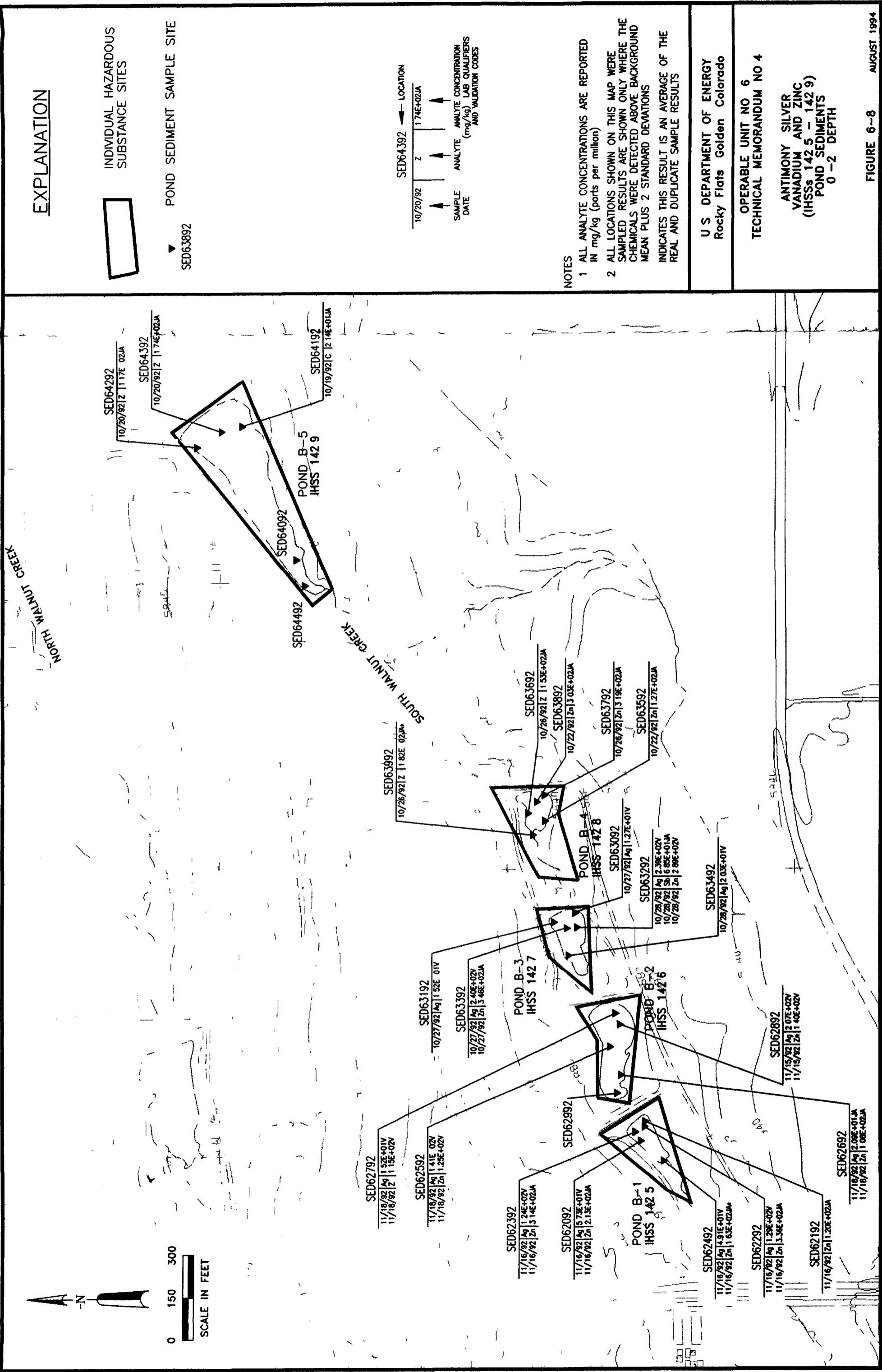
NOTES

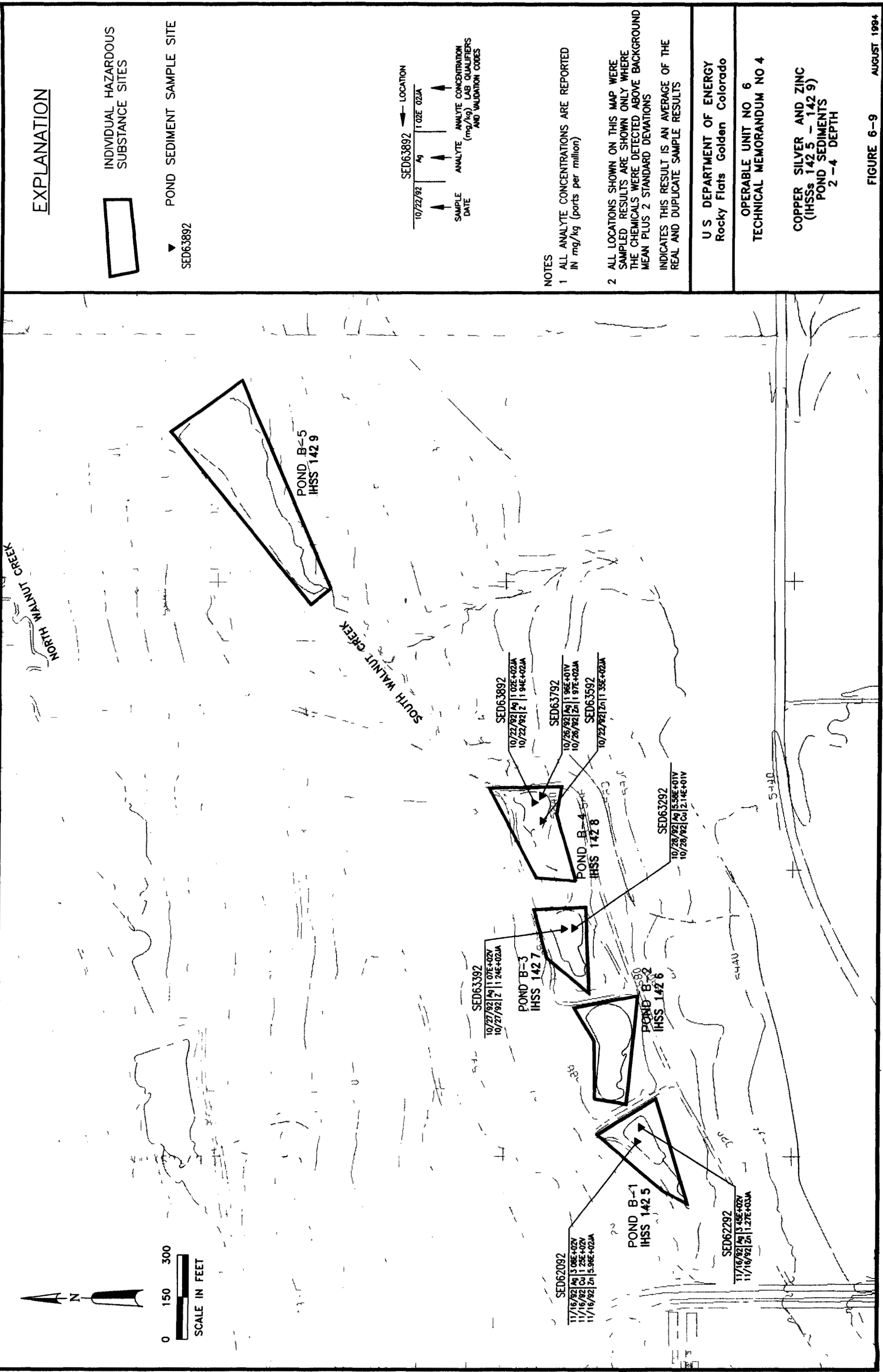
- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN mg/kg (parts per million)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U.S. DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO. 6
TECHNICAL MEMORANDUM NO. 4

ANTIMONY, VANADIUM AND ZINC
(IHSSs 142.1 - 142.4)
POND SEDIMENTS





EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

▼ POND SEDIMENT SAMPLE SITE
SED63892

SED63892
10/22/92 Ag 1.02E+02A
SAMPLE DATE ANALYTE ANALYTE CONCENTRATION (mg/kg) LAB QUALIFIERS AND VALIDATION CODES
LOCATION

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN mg/kg (parts per million)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

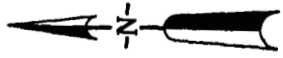
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

COPPER SILVER AND ZINC
(IHSSs 142 5 - 142 9)
POND SEDIMENTS
2-4 DEPTH

FIGURE 6-9

AUGUST 1994

OU6TMO69 1-300



0 150 300
SCALE IN FEET

UNNAMED NORTHERN TRIBUTARY

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

▼ POND SEDIMENT SAMPLE SITE
SED61492

SED60792
11/12/92 Am-241 1.740E+00A
ANALYTE ANALYTE ACTIVITY
(pCi/g) LAB QUALIFIERS
AND VALIDATION CODES
LOCATION

NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED
IN pCi/g
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED. RESULTS ARE SHOWN ONLY WHERE
THE CHEMICALS WERE DETECTED ABOVE BACKGROUND
MEAN PLUS 2 STANDARD DEVIATIONS
INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AMERICIUM-241 AND PLUTONIUM-239/240
(IHSS 142 1 - 142 4)
POND SEDIMENTS

FIGURE 6-10

AUGUST 1994

0681610 1-300

EXPLANATION

INDIVIDUAL HAZARDOUS SUBSTANCE SITES

▼ POND SEDIMENT SAMPLE SITE
SED63892

SED63592		← LOCATION	
	Am 241	2 177E+00A	↑
		ANALYTE	ANALYTE ACTIVITY (pC/g) LAB QUALIFIERS AND VALIDATION CODES
10/22/92	↑		
SAMPLE DATE			

NOTES

1 ALL ANALYTE ACTIVITIES ARE REPORTED
IN pCi/g

2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS.

INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS.

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

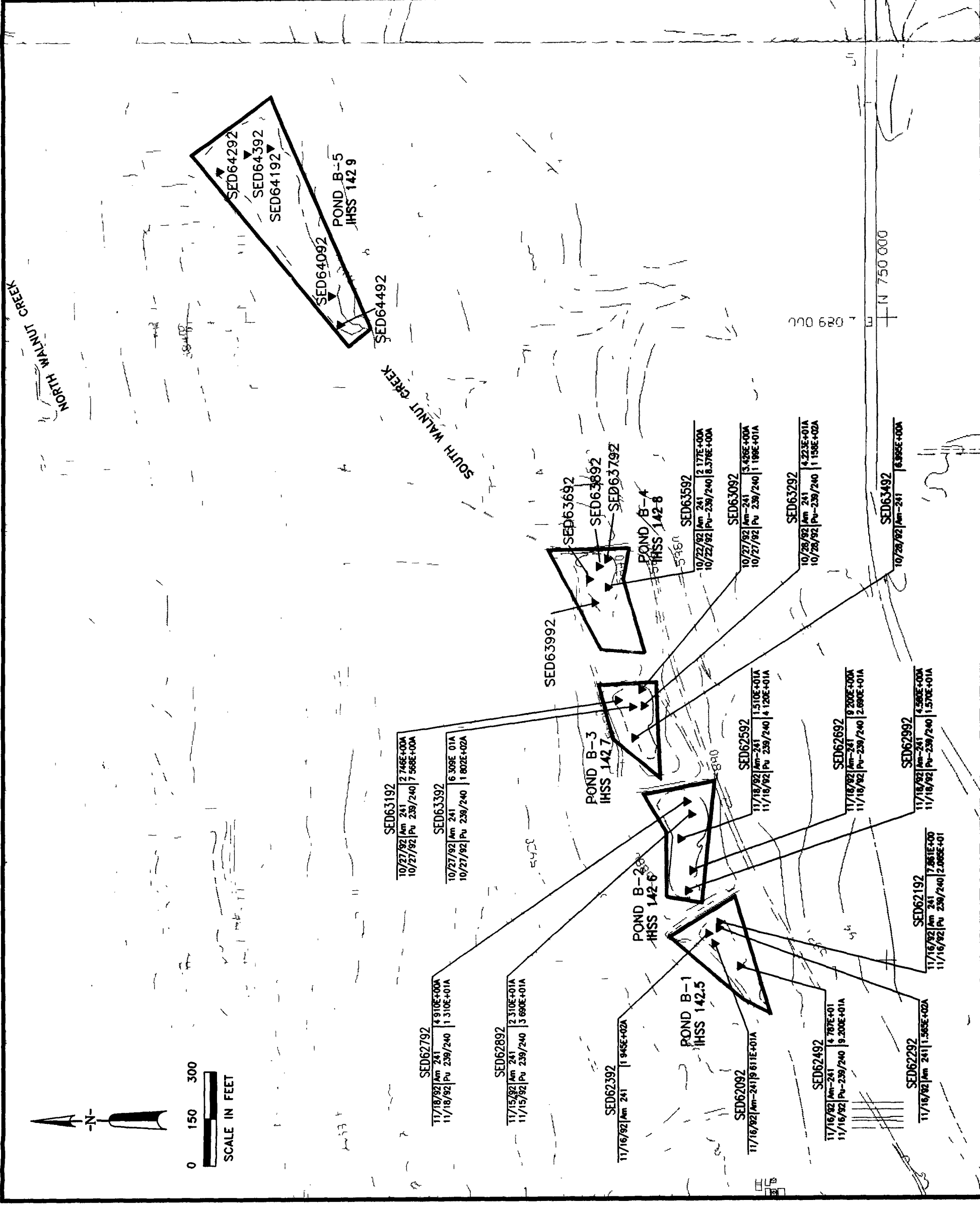
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AMERICIUM-241 AND PLUTONIUM-239/240
(HSSs 142 5 - 142 9)
POND SEDIMENTS
0 - 2 DEPTH

FIGURE 6-11

AUGUST 1994

OU67M611 1-300



EXPLANATION

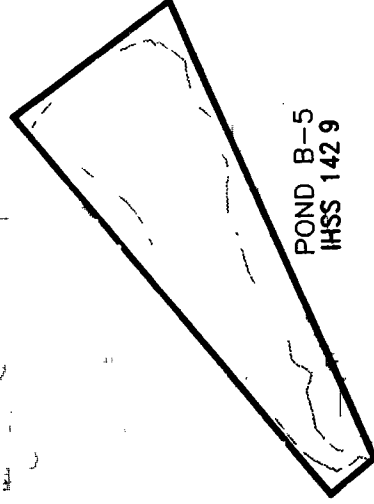
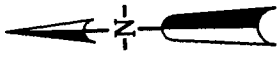
INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



▼ POND SEDIMENT SAMPLE SITE
SED63892



SCALE IN FEET



SOUTH WALNUT CREEK

NORTH WALNUT CREEK

POND B-4
IHSS 142.8

POND B-3
IHSS 142.7

POND B-2
IHSS 142.6

POND B-1
IHSS 142.5

SED62092
11/16/92|Am 241|5.884E+02A

SED63892

10/22/92|Am 241|7.452E+00A
10/22/92|Pu 239/240|2.409E+01A

SED63792

10/26/92|Am 241|2.560E+00A
10/26/92|Pu 239/240|9.577E+00A

SED63592

10/22/92|Am 241|3.457E+00A
10/22/92|Pu 239/240|1.116E+01A

SED63392

10/27/92|Am 241|1.194E+01A
10/27/92|Pu 239/240|4.654E+01A

SED63292

10/26/92|Am 241|1.651E+00A
10/26/92|Pu 239/240|5.560E+00A

SED62292

11/16/92|Am 241|1.224E+02A

SED63892

10/22/92	Am-241	7.452E+00A	LOCATION
↑	↑	↑	↑
SAMPLE DATE	ANALYTE	ANALYTE ACTIVITY (pCi/g) LAB QUALIFIERS AND VALIDATION CODES	

NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED
IN pCi/g
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE
SAMPLED RESULTS ARE SHOWN ONLY WHERE
THE CHEMICALS WERE DETECTED ABOVE BACKGROUND
MEAN PLUS 2 STANDARD DEVIATIONS
INDICATES THIS RESULT IS AN AVERAGE OF THE
REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

AMERICIUM-241 AND PLUTONIUM-239/240
(IHSSs 142.5 - 142.9)
POND SEDIMENTS
2-4 DEPTH

FIGURE 6-12

AUGUST 1994

0367M612 1 300

EXPLANATION

INDIVIDUAL HAZARDOUS SUBSTANCE SITES

▼ POND SURFACE WATER
SW64192 SAMPLE SITE

10/1/92	CHC13 (V)	2 OE 00A	LOCATION
▲	▲		
		ANALYTE	ANALYTE CONCENTRATION (g/l)
			LAB QUALIFIERS AND VALIDATION CODES

(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/l (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED

INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

U S DEPARTMENT OF ENERGY
Rocky Flats Golden Colorado

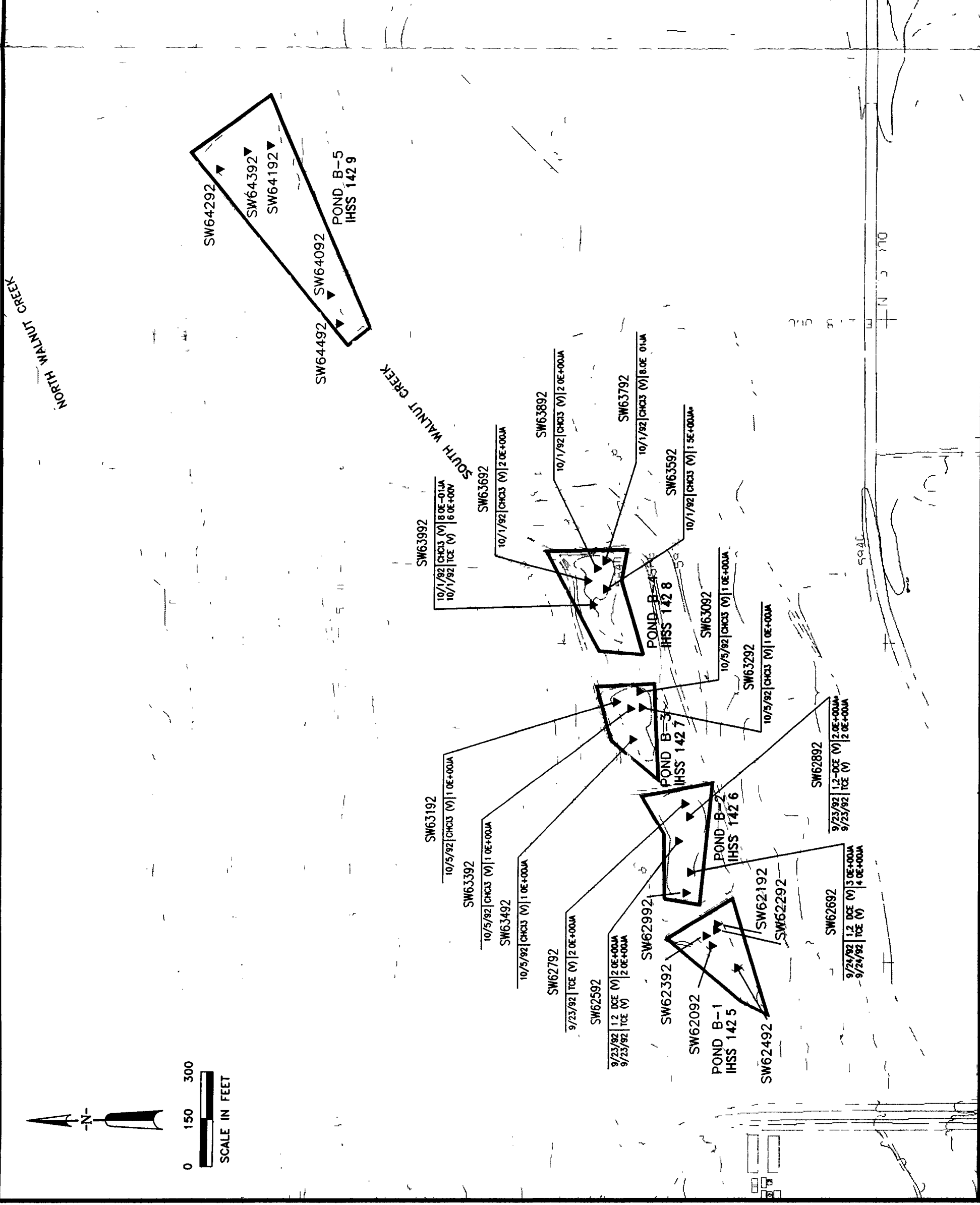
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TECHNICAL MEMORANDUM NO 4

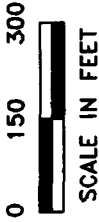
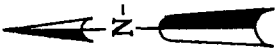
1 2-DICHLOROETHENE CHLOROFORM
AND TRICHLOROETHENE
(IHSS 142.5 - 142.9)
POND SURFACE WATER

FIGURE 7-1

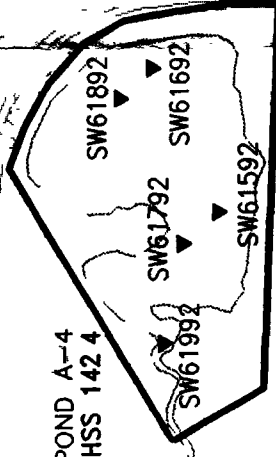
AUGUST 1994

0U67M071 1=300

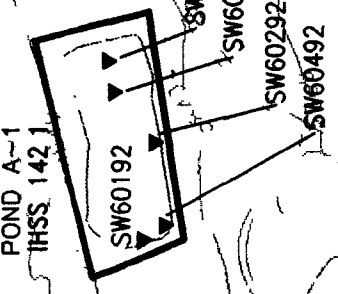
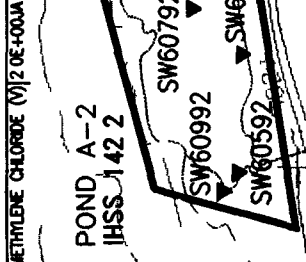
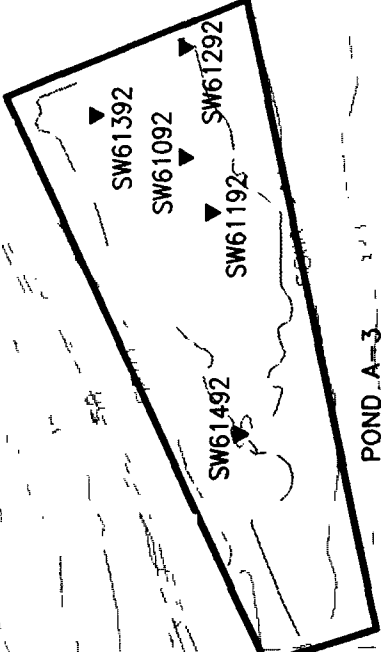




UNNAMED NORTHERN TRIBUTARY



NORTH WALNUT CREEK



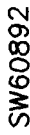
SOUTH WALNUT CREEK

EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



POND SURFACE WATER
SAMPLE SITE



SW60892

SW60892

9/16/92 METHYLENE CHLORIDE (V) 12.0E+000A

SAMPLE
DATE

ANALYTE
CONCENTRATION
(ug/l) LAB QUALIFIERS
AND VALIDATION CODES



ANALYTE
CONCENTRATION
(ug/l) LAB QUALIFIERS
AND VALIDATION CODES

(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/l (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

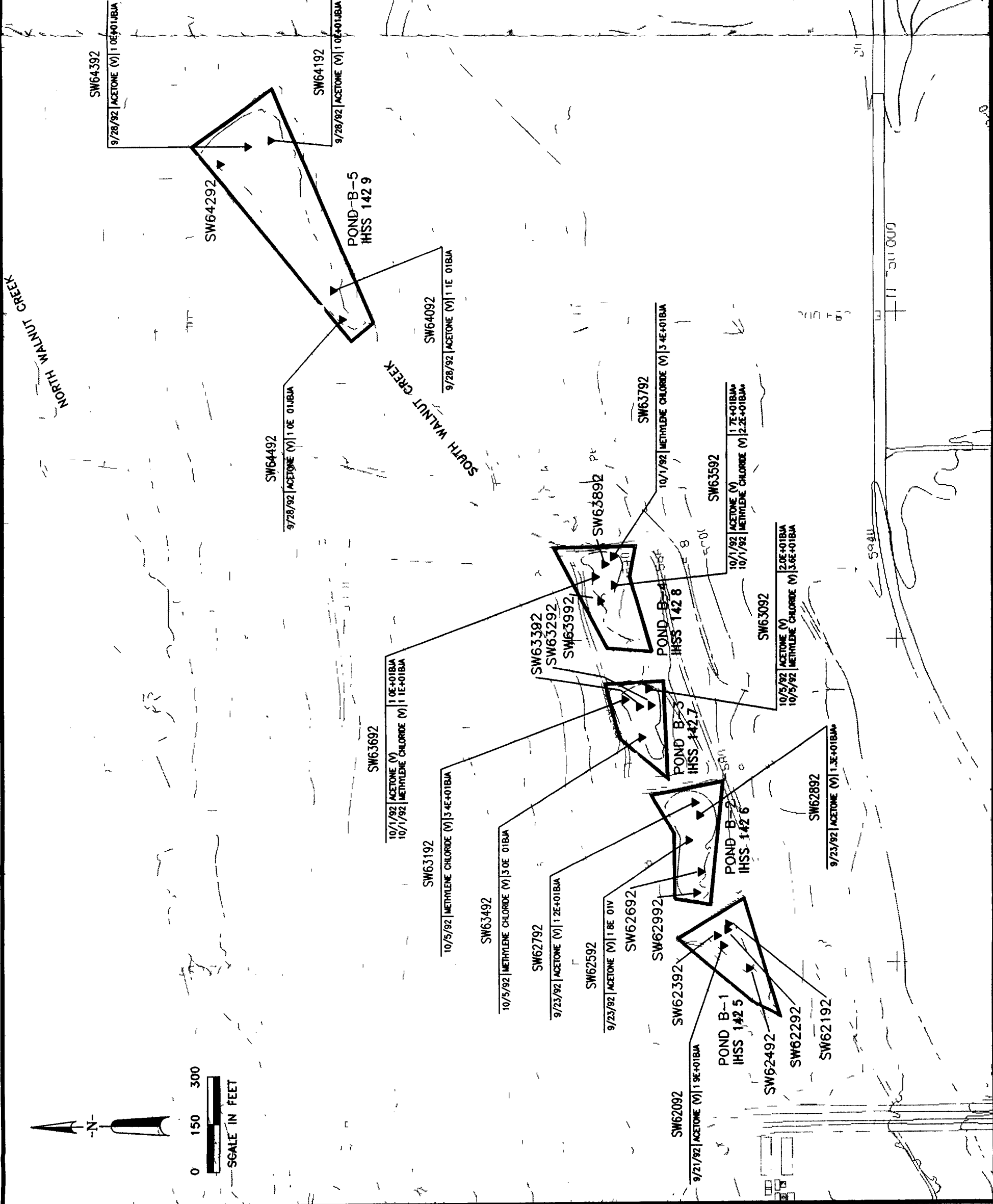
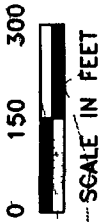
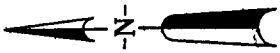
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Rocky Flats Golden Colorado

OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

METHYLENE CHLORIDE
(IHSS 142 1 - 142 4)
POND SURFACE WATER

FIGURE 7-2

AUGUST 1994



EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

SURFACE WATER SAMPLE SITE
(POND WATER)

SW64292

SW64192

9/28/92 | ACETONE (V) | 1.0E+01BUA
↑
ANALYTE
↑
ANALYTE CONCENTRATION
(ug/l) LAB QUALIFIERS
AND VALIDATION CODES

(V) - VOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/l (parts per billion)
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

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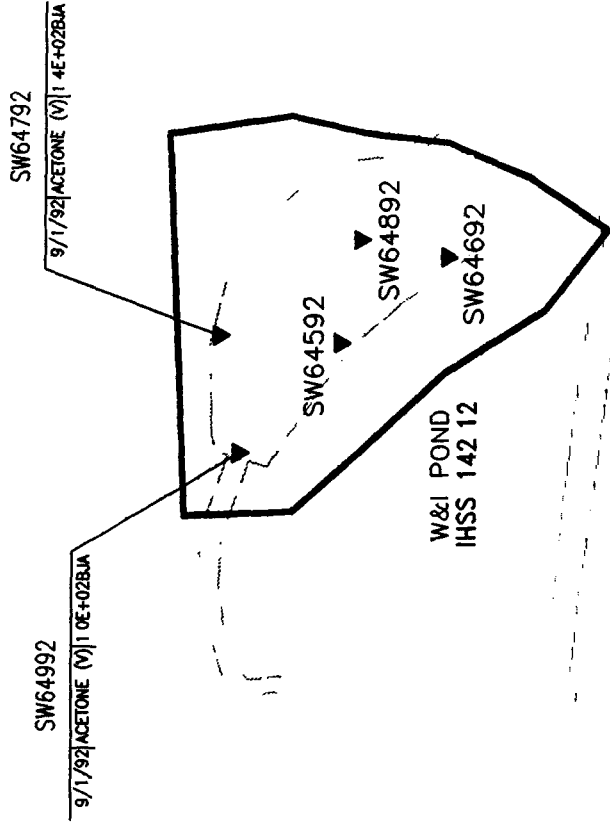
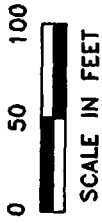
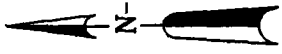
OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

ACETONE AND METHYLENE CHLORIDE
(IHSS 142.5 - 142.9)
POND SURFACE WATER

FIGURE 7-3

AUGUST 1994

00670073 1-300



EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES

POND SURFACE WATER
SAMPLE SITE
SW64792

SW64792		LOCATION
9/1/92	ACETONE (V)	1.4E+02BIA
↑	↑	↑
SAMPLE DATE	ANALYTE (g/l) LAB QUALIFIERS AND VALIDATION CODES	ANALYTE CONCENTRATION

(V) - VOLATILE

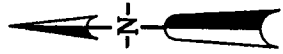
NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/l (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

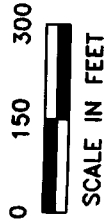
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ACETONE
(IHSS 142 12)
POND SURFACE WATER



UNNAMED NORTHERN TRIBUTARY



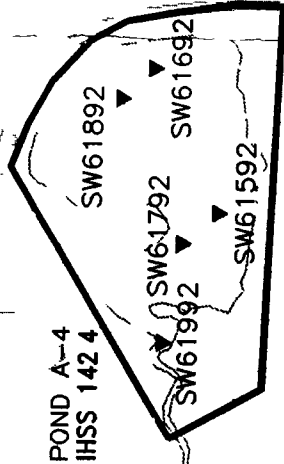
EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



POND SURFACE WATER
SAMPLE SITE

SW61892



NORTH WALNUT CREEK

SW61492
9/10/92|U 235|2.40E-01A
9/10/92|U 238|3.70E+00A

SW60992
9/15/92|U 238|3.30E+00A
SW60592
9/16/92|U 238|4.10E 00A

SW60292
9/16/92|U 238|3.92E+00A

POND A-1
IHSS 142.1
SW60192
9/17/92|U 238|4.48E+00A

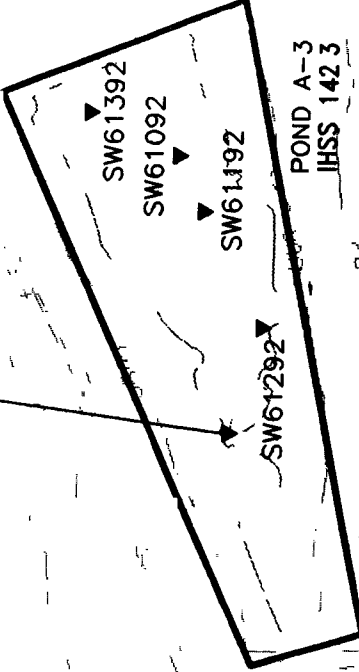
SW60092
9/16/92|U 235|3.00E-01A
9/16/92|U 238|3.58E+00A

SW60392
9/17/92|U 233 234|3.68E+00A
9/17/92|U 235 3.70E-01A
9/17/92|U 238 4.05E+00A

SW60892
9/16/92|U 238|3.52E 00A

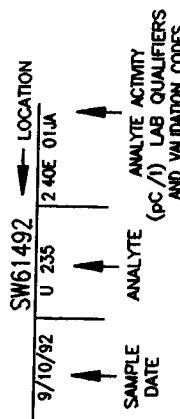
SW60792
9/10/92|U 238|3.50E+00A

SW60692
9/16/92|U 238|3.78E+00A



POND A-3
IHSS 142.3

SOUTH WALNUT CREEK



NOTES

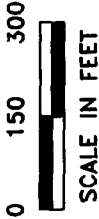
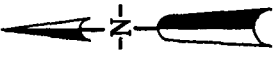
- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN pCi/l
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

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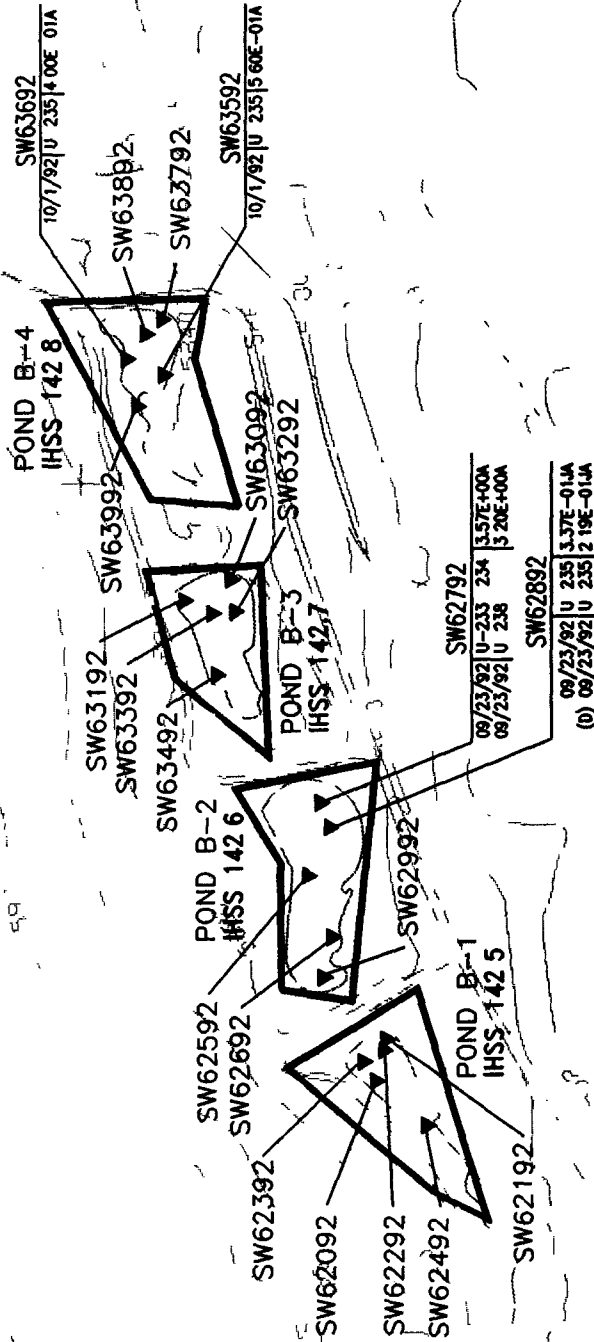
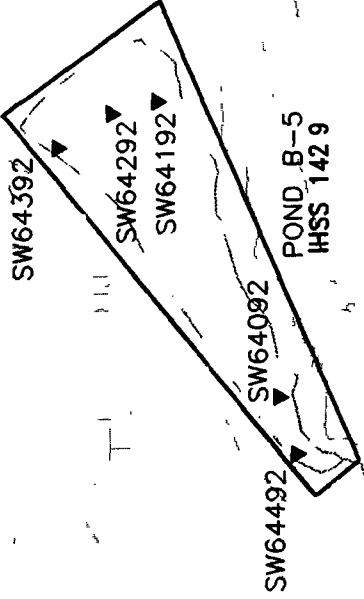
URANIUM-233/234 URANIUM-235
AND URANIUM-238
(IHSSs 142.1 - 142.4)
POND SURFACE WATER

FIGURE 7-5



NORTH WALNUT CREEK

SOUTH WALNUT CREEK



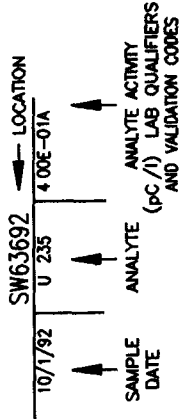
EXPLANATION

INDIVIDUAL HAZARDOUS
SUBSTANCE SITES



▼ POND SURFACE WATER
▼ SAMPLE SITE

SW64392



NOTES

- 1 ALL ANALYTE ACTIVITIES ARE REPORTED IN PC/I
- 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED. RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED ABOVE BACKGROUND MEAN PLUS 2 STANDARD DEVIATIONS. INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS
- (D) INDICATES THE SAMPLE WAS COLLECTED AT A DEPTH GREATER THAN 4.5 FEET

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OPERABLE UNIT NO 6
TECHNICAL MEMORANDUM NO 4

URANIUM-233/234 URANIUM-235
AND URANIUM-238
(IHSSs 142.5 - 142.9)
POND SURFACE WATER

EXPLANATION

INDIVIDUAL HAZARDOUS SUBSTANCE SITES

□ GS03
STREAM SEDIMENT SAMPLING SITE
(SED68492)

SED68492	← LOCATION
5/06/93	← LOCATION
BD00X	← ANALYTE
PTRENE(SV)	← ANALYTE CONCENTRATION (ug/kg)
1E+024A	← LAB QUALIFIERS AND VALIDATION CODES

(SV) – SEMVOLATILE

NOTES

- 1 ALL ANALYTE CONCENTRATIONS ARE REPORTED IN ug/kg (parts per billion)
 - 2 ALL LOCATIONS SHOWN ON THIS MAP WERE SAMPLED RESULTS ARE SHOWN ONLY WHERE THE CHEMICALS WERE DETECTED
- INDICATES THIS RESULT IS AN AVERAGE OF THE REAL AND DUPLICATE SAMPLE RESULTS

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TECHNICAL MEMORANDUM NO 4

**PAH COCs
OU6 DRAINAGES
STREAM SEDIMENTS**

FIGURE 8-1

AUGUST 1994

0U6TM081 1-1200